

**NASA**

**Aerospace Medicine  
and Biology**  
A Continuing  
Bibliography  
with Indexes

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(NASA-SP-7011(288)) AEROSPACE MEDICINE AND  
BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH  
INDEXES (SUPPLEMENT 288) (National  
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## ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

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N86-24652 – N86-26276

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A86-33481 – A86-37139

# **AEROSPACE MEDICINE AND BIOLOGY**

## **A CONTINUING BIBLIOGRAPHY WITH INDEXES**

**(Supplement 288)**

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in August 1986 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



Scientific and Technical Information Branch  
**National Aeronautics and Space Administration**  
Washington, DC

1986

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# INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 190 reports, articles and other documents announced during August 1986 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects of biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

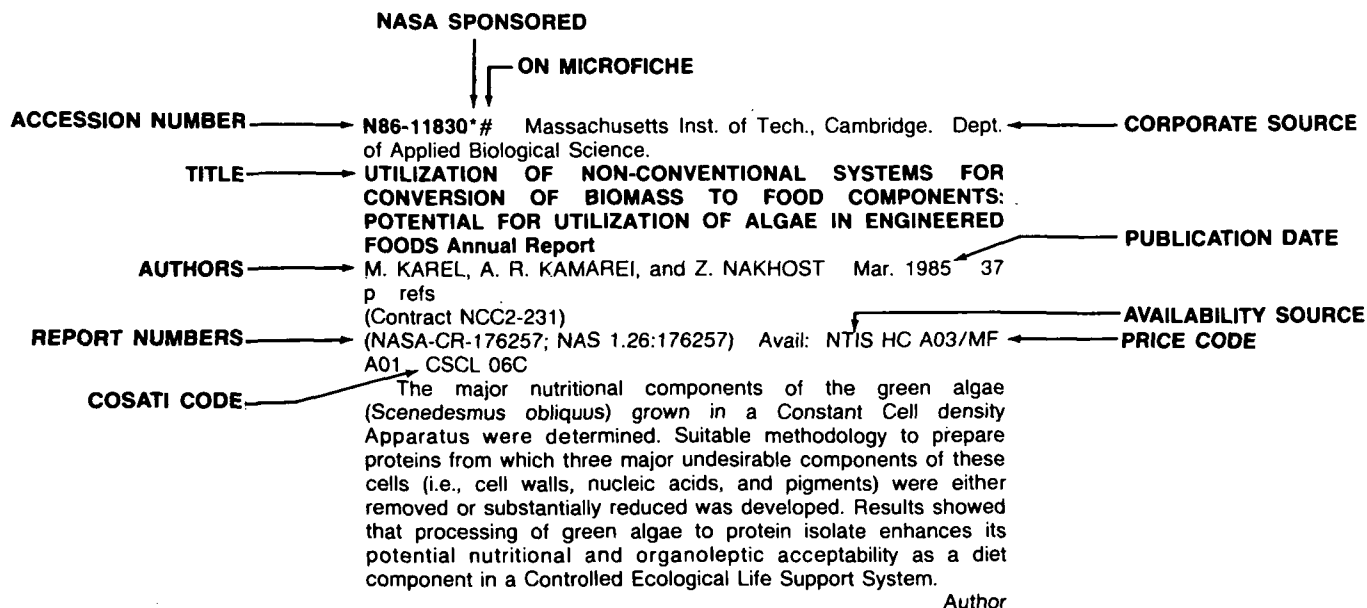
Seven indexes -- subject, personal author, corporate source, foreign technology, contract, report number, and accession number -- are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1986 Supplements.

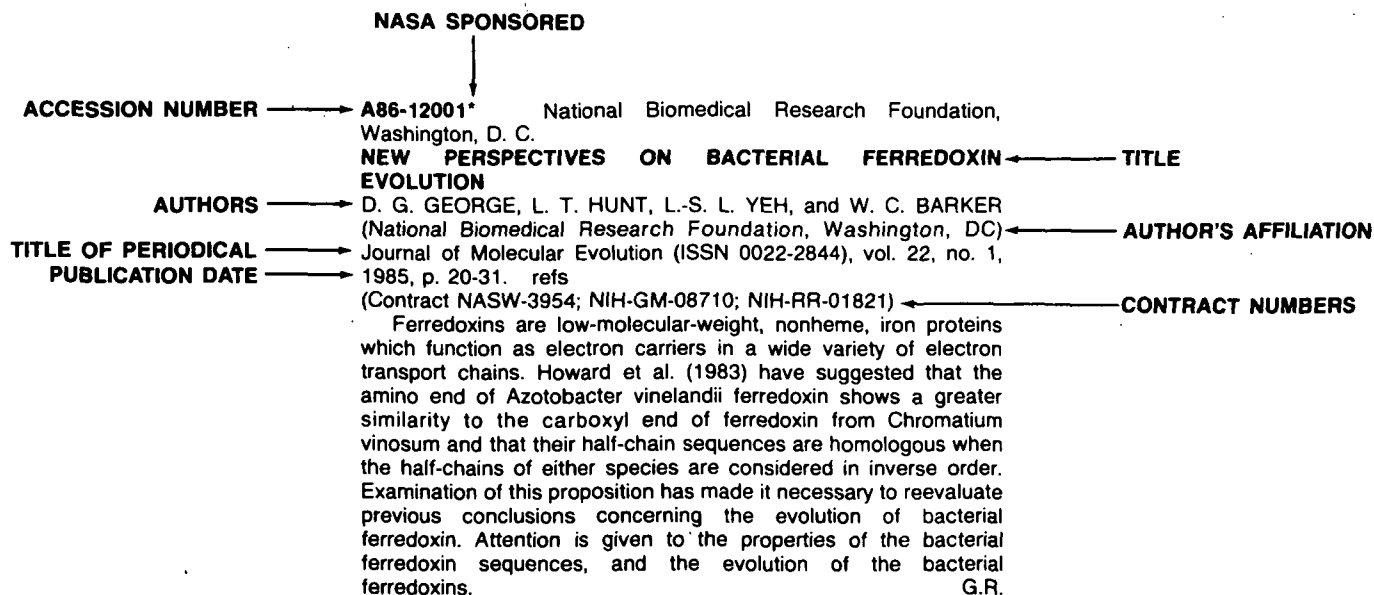
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## TYPICAL REPORT CITATION AND ABSTRACT



## TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



# AEROSPACE MEDICINE AND BIOLOGY

*A Continuing Bibliography (Suppl. 288)*

SEPTEMBER 1986

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## LIFE SCIENCES (GENERAL)

Includes genetics.

**A86-33761**

### TOPICAL EFFECTS OF MOLTEN SALT ON RAT INTEGUMENT - A HISTOLOGICAL AND PHOTOMETRIC ASSESSMENT

W. J. MEHM, J. B. NOLD, and R. C. ZERNZACH (U.S. Air Force Academy, Colorado Springs, CO) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, April 1986, p. 362-366. USAF-supported research. refs

The topical effects of the molten salt 1-methyl-3-ethyl-imidazolium tetrachloroaluminate (melt) and its organic component, the organic salt 1-methyl-3 ethylimidazolium chloride were tested on rat integument. Evaluation was accomplished using standard histological techniques supplemented with digital analysis using the microscope photometer. Two groups of animals were treated with 1.5 ml of either the melt or the organic salt for 10 consecutive days. A third group treated with the melt had the treated area flushed with running water 5 min after each application (wash). Significant treatment effects were observed in rats treated with the melt and wash preparations while the effects of the organic salt were unremarkable. The melt induced an ulcerative dermatitis with acanthosis while the wash produced only mild acanthosis and dermatitis. This damage appears to result from the penetration of aluminum chloride in the melt through the skin and its toxic effects on the cells of the dermis and epidermis. Author

**A86-34490**

### SYNCHRONIZATION OF HEART CONTRACTIONS AND RESPIRATION DURING THERMOREGULATORY POLYPNEA IN DOGS [SINKHORIZATSIYA SERDECHNYKH SOKRASHCHENII I DYKHANIYA PRI TERMOREGULIATSIONNOM POLIPNOE U SOBAK]

V. M. POKROVSKII, V. G. ABUSHKEVICH, A. I. DASHKOVSKII, E. A. MALIGONOV, S. V. SHAPIRO (Kubanskii Meditsinskii Institut, Krasnodar, USSR) et al. Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 287, no. 2, 1986, p. 479-481. In Russian. refs

The heart contraction and respiratory rates were recorded in dogs placed into a thermoregulated chamber with controlled ventilation. In unanesthetized dogs, an increase in respiratory rate, occurring 60 to 90 minutes after the temperature was raised to 38 C, was followed by an increase in the heart rate. After about 135 min at 38 C, both cardiac and respiratory rates increased to 182/min, with one breath corresponding to one heart contraction. When the respiratory rate increased or decreased, the rate of heart contractions changed synchronously. The results suggest that, when the respiratory rate surpasses the heart rate, a common rhythm, dominated by the respiratory rhythm, develops in the cardiac and respiratory regulatory brain centers. The onset of heart and respiration rate synchronism was delayed in dogs under superficial anesthesia, while in dogs under deep anesthesia the phenomenon did not occur at all. I.S.

**A86-34573**

### CONCEPTS FOR THE LIFE SUPPORT SUBSYSTEM IN THE EURECA BOTANY FACILITY

H. LOESER (ERNO Raumfahrttechnik GmbH, Bremen, West Germany) (DGLR, Jahrestagung, Bonn, West Germany, Sept. 30-Oct. 2, 1985) Zeitschrift fuer Flugwissenschaften und Weltraumforschung (ISSN 0342-068X), vol. 10, Jan.-Feb. 1986, p. 13-21.

(DGLR PAPER 85-126)

The Botany Facility (BF) represents one of the core experiments considered for the second Eureka launch, which is planned for 1990. A study is to be conducted regarding the ability of plants and fungi to germinate, grow, flourish, and produce seeds and spores under conditions of weightlessness. The life support subsystem requirements are discussed along with life support subsystem concepts, and the concept of water reclamation. Attention is given to BF performance data, physiological processes in plants, upper limits of physiological rates used for the design of BF life support subsystem, the basic concepts studied for the ventilation/humidification loop, an option using water reclamation with Peltier cooling, and the concept of a cuvette with internal water management. G.R.

**A86-34984**

### PLANARIA REGENERATION IN ZERO GRAVITY

D. K. RASHKOVER IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985. Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 10-1 to 10-4. refs

The experimental requirements for the study of planaria regeneration in space are described. The temperature control system, oxygenated containers, fixative injecting device, and data collection systems are examined. The need to establish a power supply and preload time is discussed. I.F.

**A86-34985\*** Miami Univ., Fla.

### HYDROGEN PRODUCTION FROM SALT WATER BY MARINE BLUE GREEN ALGAE AND SOLAR RADIATION

A. MITSUI, D. ROSNER, S. KUMAZAWA, S. BARCIELA, E. PHILIPS (Miami, University, FL) et al. IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985. Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 11-7 to 11-14. refs

(Contract NSF CPE-80-15142; NSF CPE-83-12092; NAS10-10531)

Two marine bluegreen algae, *Oscillatoria* sp. Miami BG 7 and *Synechococcus* sp. Miami 041511 have been selected as the result of over 10 years continuous and intensive effort of isolation, growth examination, and the screening of hydrogen photoproduction capability in this laboratory. Both strains photoproduced hydrogen for several days at high rates and a quantity of hydrogen was accumulated in a closed vessel. Overall hydrogen donor substance of the hydrogen photoproduction was found to be salt water. Using strain Miami BG 7, a two step method of hydrogen photoproduction from salt water was successfully developed and this was recycled several times over a one month period using both free cells and immobilized cells in both indoor and outdoor under natural sunlight. According to these experiments, a prototype floating hydrogen



production system was designed for further development of the biosolar hydrogen production system. Author

**A86-35088**  
**PROSPECTS FOR USING MILLIMETER-BAND ELECTROMAGNETIC RADIATION AS AN EFFICIENT WAY OF OBTAINING INFORMATION ON SPECIFIC PROCESSES IN LIVING ORGANISMS [O PERSPEKTIVAKH ISPOL'ZOVANIIA ELEKTROMAGNITNYKH IZLUCHENII MILLIMETROVOGO DIAPAZONA V KACHESTVE VYSOKOINFORMATIVNOGO SREDSTVA POLUCHENIIA DANNYKH O SPETSIFICHESKIKH PROTSSESAKH V ZHIVYKH ORGANIZMAKH]**

N. D. DEVIATKOV and M. B. GOLANT Pis'ma v Zhurnal Tekhnicheskoi Fiziki (ISSN 0320-0016), vol. 12, March 12, 1986, p. 288-291. In Russian. refs

Various types of electromagnetic radiation are examined from the standpoint of their information content in diagnosing living organisms. It is shown that the information value of millimeter waves is particularly high due to both a low wave propagation velocity and low energy requirements for vibration excitation at resonance frequencies characterizing the state of an organism. It is noted that millimeter waves may be particularly useful for diagnosing diseases on the basis of a radiation spectrum analysis. V.L.

**A86-35863#**  
**COMPARATIVE STUDY OF ACETAZOLAMIDE AND SPIRONOLACTONE ON REGIONAL BLOOD DISTRIBUTION ON EXPOSURE TO ACUTE HYPOBARIC HYPOXIA**

S. C. JAIN, M. V. SINGH, S. B. RAWAL, H. M. DIVEKAR, and R. PARSHAD (Defence, Institute of Physiology and Applied Sciences, Delhi, India) Defence Science Journal (ISSN 0011-748X), vol. 35, Oct. 1985, p. 425-429. refs

Regional blood distribution was studied in rats, which were divided into four groups viz., (1) control, (2) exposed to acute hypobaric hypoxia, (3) exposed to acute hypobaric hypoxia after oral treatment with 25 mg acetazolamide, and (4) exposed to acute hypobaric hypoxia after oral treatment with 6 mg spironolactone. The regional blood distribution was measured using radio-iodinated serum albumin (R-131 ISA). The acute hypoxic exposure results in major readjustment in the blood flow to the various organs mainly from the renal and splanchnic vascular beds to the heart and brain. Treatment with acetazolamide and spironolactone results only in a slight decrease in blood contents of the heart, brain and lung as compared to the hypoxia alone exposed group. Author

**A86-35938**  
**ANTIOXIDANTS AS ANTIARRHYTHMIC REMEDIES [ANTIOKSIDANTY KAK ANTIARITMICHESKIE SREDSTVA]**

V. V. FROLKIS, R. A. FROLKIS, G. IA. DUBUR, IU. V. KHMELEVSKII, V. G. SHEVCHUK (Institut Gerontologii; Institut Kardiologii, Kiev, Ukrainian SSR) et al. Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 32, Jan.-Feb. 1986, p. 24-32. In Russian. refs

The effect of antioxidants (alpha-tocopherol, butylated hydroxytoluene, and two derivatives of 1,4-dihydropyridine) on induced arrhythmias was studied in rats and rabbits injected with vasopressin, strophanthin, adrenalin, or calcium chloride. The results of physiological and biochemical tests have shown that preinjection with antioxidants decreases the incidence of drug-induced extrasystole, disturbances of atrioventricular conductivity, and heart fibrillation. The antioxidants prevent changes in the membrane phospholipids and activation of peroxidation, and slow down the activation of phospholipase. In addition, the antioxidants prevent decreases in Ca-ATPase and in binding and uptake of Ca(2+) by sarcoplasmic reticulum, and promote increases of sarcolemmal K,Na-ATPase and of creatine phosphokinase of sarcoplasmic reticulum. I.S.

**A86-35939**  
**CHANGES IN THE CONTRACTILE AND ELECTRICAL ACTIVITIES OF THE RAT MYOCARDIUM UNDER THE EFFECT OF VERAPAMIL UNDER INSUFFICIENT OXYGENATION [IZMENENIE SOKRATILEL'NOI I ELEKTRICHESKOI AKTIVNOSTEI MIOKARDA KRYIS POD VLIANIEM VERAPAMILA V USLOVIAKH NEDOSTATOCHNOGO OBESPECHENIIA KISLORODOM]**

I. S. MUDRAIA and IU. S. LIAKHOVICH (Ukrainskii Institut Kardiologii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 32, Jan.-Feb. 1986, p. 60-66. In Russian. refs

**A86-35940**  
**IMPULSE ACTIVITY OF THE BRAIN STEM NEURONS RELATED TO THE CARDIAC AND RESPIRATORY RHYTHMS [IMPUL'SNAIA AKTIVNOST' NEIRONOV PRODOLGOVATOGO MOZGA, SVIAZANNAIA SERDECHNYM I DYKHATEL'NYM RITMAMI]**

V. M. POKROVSKII and M. A. BOBROVA (Kubanskii Gosudarstvennyi Meditsinskii Institut, Krasnodar, USSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 32, Jan.-Feb. 1986, p. 98-102. In Russian. refs

**A86-35941**  
**GAMMA-AMINOBUTYRIC ACID AND BULBAR MECHANISMS OF HEMODYNAMIC REGULATION [GAMMA-AMINOMASLIANAIA KISLOTA I BUL'BARNYE MEKHANIZMY REGULIATSII GEMODINAMIKI]**

M. I. GUREVICH and L. N. SHAPOVAL (AN USSR, Institut Fiziologii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 32, Jan.-Feb. 1986, p. 107-114. In Russian. refs

**A86-36218**  
**IMPAIRED PULMONARY CONVERSION OF ANGIOTENSIN I TO ANGIOTENSIN II IN RATS EXPOSED TO CHRONIC HYPOXIA**

R. M. JACKSON, A. J. NARKATES, and S. OPARIL (Alabama, University, Birmingham) Journal of Applied Physiology (ISSN 0161-7567), vol. 60, April 1986, p. 1121-1127. Research supported by the American Lung Association and USVA. refs (Contract NIH-HL-22544; NIH-HL-25451)

**A86-36220**  
**PARTIAL RECOVERY OF NEUTROPHIL FUNCTIONS DURING PROLONGED HYPOTHERMIA IN PIGS**

W. D. BIGGAR, C. BARKER, D. BOHN, and G. KENT (Hospital for Sick Children, Toronto, Canada) Journal of Applied Physiology (ISSN 0161-7567), vol. 60, April 1986, p. 1186-1189. Research supported by the Medical Research Council of Canada. refs

**A86-36221**  
**ONTOGENY OF HOMEOTHERMY IN THE IMMATURE RAT - METABOLIC AND THERMAL RESPONSES**

D. E. SPIERS and E. R. ADAIR (John B. Pierce Foundation Laboratory, New Haven, CT) Journal of Applied Physiology (ISSN 0161-7567), vol. 60, April 1986, p. 1190-1197. refs (Contract NIH-HD-18002)

**A86-36223**  
**EFFECTS OF EXERCISE IN NORMOXIA AND ACUTE HYPOXIA ON RESPIRATORY MUSCLE METABOLITES**

R. F. FREGOSI and J. A. DEMPSEY (Wisconsin, University, Madison) Journal of Applied Physiology (ISSN 0161-7567), vol. 60, April 1986, p. 1274-1283. Research supported by the University of Wisconsin, and Army. refs (Contract NIH-HL-15469)

Changes in rat plantaris, diaphragm, and intercostal muscle metabolites following exercise of various intensities and durations, in normoxia and hypoxia were determined. A lack of significant glycogen utilization was found in rat respiratory muscles during all normoxic conditions, and only under conditions of extreme metabolic demand, coupled with reduced O2 transport (hypoxia) did glycogen utilization increase. The initial utilization lack was

associated with elevated G6P levels. ATP concentration was maintained in all muscles, in all conditions studied, but at the expense of creatine phosphate in the diaphragm and plantaris at maximum oxygen intake (VO<sub>2</sub>max). With all types of exercise greater than 84 pct VO<sub>2</sub>max, respiratory and locomotor muscle lactate concentrations increased, though these concentrations were either equal to or lower than arterial lactate concentration, and the increase in diaphragm lactate occurred without glycogen utilization. This lactate elevation in the absence of glycogen utilization suggests that increased lactate uptake, rather than lactate production, occurred in the respiratory muscles during exhaustive exercise. K.K.

**A86-36225****EFFECTS OF PRESSURE ON UPTAKE AND RELEASE OF CALCIUM BY BRAIN SYNAPTOSOMES**

S. C. GILMAN, K. K. KUMAROO, and J. M. HALLENBECK (U.S. Navy, Hyperbaric Medicine Program Center, Bethesda, MD; George Washington University, Washington, DC) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 60, April 1986, p. 1446-1450. refs

(Contract NAVY TASK MR041,01,01,1124)

Uptake of radioactive calcium from guinea pig brain fractions enriched in synaptosomes could be significantly and reproducibly decreased by exposure to high pressure. Calcium efflux from preloaded synaptosomes was unaffected by pressure exposure. It was hypothesized that the development of pressure-induced encapalopathy may be related to an effect of pressure on the central nervous system calcium transport system. Author

**A86-36368****IRON-SILICA CRYSTALLITE NUCLEATION BY BACTERIA IN A GEOTHERMAL SEDIMENT**

F. G. FERRIS, W. S. FYFE (Western Ontario, University, London, Canada), and T. J. BEVERIDGE (Guelph, University, Canada) *Nature* (ISSN 0028-0836), vol. 320, April 17, 1986, p. 609-611. Research supported by the Ontario Geoscience Research Program. refs

The recognition of microfossils in ancient sedimentary rocks has confirmed that microorganisms which strongly resemble present-day prokaryotes existed at least 3 billion years ago. Identification of these structures is a difficult task, complicated not only by the simple morphology of microorganisms, but also by our limited understanding of the processes leading to the mineralization of individual cells and their component parts. These processes have been investigated in a natural setting, by examining sediment samples from an acidic hot spring in Yellowstone National Park. Electron microscopy and energy-dispersive X-ray spectroscopy of thin-sectioned specimens revealed remains of bacteria inside accumulations of iron and silica. Bacterial-like forms in successive stages of mineral preservation by silica were also found. Author

**A86-36494****THE EFFECT OF ELECTROMAGNETIC RADIATION IN THE DECIMETER WAVELENGTH RANGE ON THE NEURONAL CALCIUM CURRENT IN MOLLUSKS [VLIANIE ELEKTROMAGNITNOGO IZLUCHENIIA V TOKSIMETROVOM DIAPAZONE DLIN VOLN NA KAL'TSIEVYI DOK NEIRONOV MOLLIUSKA]**

S. I. ALEKSEEV, V. I. ILIN, and V. V. TIAZHELOV (AN SSSR, Institut Biologicheskoi Fiziki, Pushchino, USSR) *Biofizika* (ISSN 0006-3029), vol. 31, Mar.-Apr. 1986, p. 264-268. In Russian. refs

**A86-36496****A MODEL OF THE SYSTEM CONTROLLING INVOLUNTARY EYE MOVEMENTS [MODEL' SISTEMY UPRAVLENIIA NEPROIZVOL'NYMI DVIZHENIAMI GLAZI]**

V. M. GUSEV and N. F. PODVIGIN (AN SSSR, Institut Fiziologii, Leningrad, USSR) *Biofizika* (ISSN 0006-3029), vol. 31, Mar.-Apr. 1986, p. 309-312. In Russian. refs

A mathematical model for the system controlling involuntary eye movements is developed in the framework of existing concepts of vision control, i.e., a correlated control of head and eye movements. The optimal control model is constructed using the quadratic criterion as a qualitative biochemical standard. Computed results are compared with experimental data on involuntary eye movements of a cat. An expression is presented for estimating the relationship between the parameters of the biochemical criterion and the retinotropic connections of a discrete locus in the external geniculate body. I.S.

**A86-36497****THE RHYTHMS OF PARAMAGNETIC-CENTER CONCENTRATION IN MOUSE LIVER AND A MATHEMATICAL MODEL OF SYNCHRONIZED AUTOOSCILLATIONS [RITMY KONTSENTRATSII PARAMAGNITNYKH TSENTRV V PECHENI MYSHEI I MATEMATICHESKAIA MODEL' SINKHRONIZIROVANNYKH AVTOKOLEBANII]**

V. M. CHIBRIKIN (AN SSSR, Institut Khimicheskoi Fiziki, Moscow, USSR), A. G. IVANNIKOVA, and V. S. SOKOLOV *Biofizika* (ISSN 0006-3029), vol. 31, Mar.-Apr. 1986, p. 324-329. In Russian. refs

Circadian rhythms of changes in concentration of paramagnetic particles (PMP) in mammalian liver were studied in intact mice by the method of paramagnetic electron resonance. The results were compared with the parameters obtained for a mathematical model in which the PMP biorhythms are assumed to be harmonic autooscillations subject to weak synchronization by an external electromagnetic source. Interrelation studies show the amplitude of the modeled external synchronizer to be one order of magnitude lower than the amplitude of the PMP biorhythms. It is suggested that the daily variations in the geomagnetic field intensity can serve as an external synchronizer for the biological PMPs. I.S.

**A86-36498****THE EFFECT OF EXTERNAL FACTORS ON THE REACTIONS MODELING BIOLOGICAL PROCESSES (PICCARDI TEST) [VLIANIE VNESHNIKH FAKTOROV NA REAKTSII, MODELIRUIUSHCHIE BIOLOGICHESKIE PROTSESSY /TEST PIKKARDI/]**

A. M. OPALINSKAIA (Tomskii Gosudarstvennyi Universitet, Tomsk, USSR) *Biofizika* (ISSN 0006-3029), vol. 31, Mar.-Apr. 1986, p. 330-335. In Russian. refs

Data are presented on long-term studies concerning the effects of cosmoheliogeophysical factors on the hydrolysis of BiCl<sub>3</sub> (Piccardi test) used as a model for studying cosmoregulation of biological processes. Changes, observed in the course of a year, in the time needed to sediment certain amounts of BiOCl from a standard reaction mixture were shown to correlate with such factors as the thunderstorm activity, the polarity of the interplanetary magnetic field, geomagnetic storms, and the rotation of the sun. In experiments conducted behind steel and Permalloy, shields fluctuations in the sedimentation time were minimized, demonstrating that the external electromagnetic fields play a prominent role in the observed correlation phenomena. I.S.

## 51 LIFE SCIENCES (GENERAL)

**N86-25109#** Management and Technical Services Co., Washington, D.C.  
**USSR SPACE LIFE SCIENCES DIGEST, ISSUE 5 Final Report**  
L. R. HOOKE, ed., M. RADTKE, ed., V. GARSHNEK, ed., R. TEETER, ed., and J. E. ROWE, ed. (Library of Congress, Washington, D.C.) Washington NASA Apr. 1986 119 p  
(Contract NASW-3676)  
(NASA-CR-3922(05); NAS 1.26:3922(05)) Avail: NTIS HC A06/MF A01 CSCL 06C

This is the fifth issue of NASA's USSR Space Life Sciences Digest. It contains abstracts of 37 papers recently published in Russian language periodicals and bound collections and of 11 new Soviet monographs. Selected abstracts are illustrated with figures and tables from the original. Additional features include a translated interview, a book review and a conference description and abstracts or titles of relevant Soviet papers presented in English at international conferences. The materials covered in this issue have been identified as relevant to 26 areas of aerospace medicine and space biology. These areas are biological rhythms, biospherics, body fluids, botany, cardiovascular and respiratory systems, endocrinology, exobiology, genetics, group dynamics, habitability and environment effects, health and medical treatment, hematology, human performance, immunology, mathematical modeling, metabolism, microbiology, morphology and cytology, musculoskeletal system, neuropsychological, nutrition, perception, personnel selection, psychology, and radiobiology. Author

**N86-25110#** Army Research Inst. of Environmental Medicine, Natick, Mass.  
**RESEARCH ANIMAL STANCHION AND TRANSPORTER**  
V. A. FORTE, JR. and W. A. SAWYER Jan. 1986 16 p refs  
(AD-A163907; USARIEM-M-12/86) Avail: NTIS HC A02/MF A01 CSCL 06C

A stanchion has been designed to restrain mid-size laboratory animals such as goats, dogs, and pigs while performing respiratory and surgical procedures. The restraint device permits control of the animal during induction and recovery from general anesthesia, provides transportation between locations, and constrains the animal during surgery without the need of a shackle device. GRA

**N86-25970\*#** California Univ., San Francisco. Contracts and Grants Office.  
**PHOTOENERGY TRANSDUCTION IN HALOBACTERIUM HALOBIVM Final Report, 1 Jul. 1975 - 31 Oct. 1985**  
W. STOECKENIUS and R. A. BOGOMOLNI 1985 9 p refs  
(Contract NSG-7151)  
(NASA-CR-176673; NAS 1.26:176673) Avail: NTIS HC A02/MF A01 CSCL 06C

The structure and function of a rhodopsin-like pigment bacteriorhodopsin, discovered and isolated from the membranes of the halophile *Halobacterium halobium*, were studied. Intermediate appearing in the cyclic photoreaction that drives the proton translocation, were spectroscopically characterized. The charge translocation in membrane monolayers and multilayers placed between electrodes were kinetically resolved. A model was developed for the proton translocation process, in which the isomerization of the retinal Schiff base decreases its pK to drive the proton off and simultaneously changes the connectivity from the cytoplasmic surface to the external surface. The stoichiometry of proton pumping in intact cells and the effect of the light generated electrochemical potential on the kinetics of the photoreaction cycle and the synthesis of ATP were investigated. B.G.

**N86-25971\*#** Management and Technical Services Co., Washington, D.C.  
**USSR SPACE LIFE SCIENCES DIGEST: INDEX TO ISSUES 1-4**  
R. TEETER and L. R. HOOKE Jun. 1986 78 p refs  
(Contract NASW-3676)  
(NASA-CR-3922(06); NAS 1.26:3922(06)) Avail: NTIS HC A05/MF A01 CSCL 06C

This document is an index to issues 1 to 4 of the USSR Space Life Sciences Digest and is arranged in three sections. In

section 1, abstracts from the first four issues are grouped according to subject; please note the four letter codes in the upper right hand corner of the pages. Section 2 lists the categories according to which digest entries are grouped and cites additional entries relevant to that category by four letter code and entry number in section 1. Refer to section 1 for titles and other pertinent information. Key words are indexed in section 3. Author

**N86-25972#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.  
**THE FIRST CORTICAL IMPLANT OF A SEMICONDUCTOR MULTIELECTRODE ARRAY. VER (VISUAL EVOKED RESPONSES) AND PROPAGATION ANALYSIS M.S. Thesis**  
P. B. FITZJARRELL and R. L. SMALL Dec. 1985 185 p refs  
(AD-A164015; AFIT/GE/ENG/85D-15) Avail: NTIS HC A09/MF A01 CSCL 05J

This thesis reports results of the analysis of data collected from the first cortical implant of an electrode array on the primary visual cortex of a laboratory beagle. No evidence of visual evoked responses (VERs) was found in the data by summation and averaging techniques. Spatial correlation results indicate support of the hyper-column theory. Spatio-temporal correlation results indicate EEG signal propagation among the cortical columns under the array. Lack of any classic VER findings may be due to data digitization errors. Major recommendations include redigitization of the beagle data, as well as procedures for future chip implants and analyses using the Masscomp MC-500 computer. Author (GRA)

**N86-25973#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.  
**PHOSPHOROBACTERIN AND ITS EFFECTIVENESS**  
Y. N. MISHUSTIN 30 Jan. 1986 60 p refs Transl. into ENGLISH from Izvestiya Timiryazevskoy Sleskokhozyaystvennoy Akademii (USSR), no. 4, 1967 p 65-83  
(AD-A164508; FTD-ID(RS)T-1432-84) Avail: NTIS HC A04/MF A01 CSCL 02A

As a result of works, carried out in institute of agricultural microbiology All-Union Academy of Agricultural Sciences proposed as bacterial fertilizing preparation, phosphorobacterin, which contains culture of spore-forming bacterium *Bac. megaterium*. This microorganism is capable to destroy organophosphorus compounds and to convert them into the form accessible to plants. Under field conditions phosphorobacterin, i.e., the preparation containing *Bac. megaterium*, slightly increases the yield of farm crops. According to the data of experimental institutions, the average increase in yield is about 10%. The available data show that phosphorobacterin is more effective on the soils where phosphoacid fertilizers were applied. This gives rise to doubt as to the thesis that phosphorobacterin mainly improves phosphorus nutrition of plants. One may also consider it proved that *Bac. megaterium* has not any active propagation on the root surface and in the rhizosphere of plants. This fact makes one give up the theory of R.A. Menkina, the author of phosphorobacterin, about the nature of the relationship between higher plants and *Bac. megaterium*. The available data makes one believe that the effect of phosphorobacterin is due to the presence in *Bac. megaterium* culture of a number of biologically active substances stimulating the first stages of the development of bacterial plants. GRA

**N86-25974#** Department of the Navy, Washington, D. C.  
**BIOSENSORS FROM MEMBRANE PROTEINS RECONSTITUTED IN POLYMERIZED LIPID BILAYERS Patent Application**  
P. YAGER, inventor (to Navy) 23 Aug. 1985 18 p  
(AD-D012160; US-PATENT-APPL-SN-768650) Avail: NTIS HC A02/MF A01 CSCL 06A

It is an object of the present invention to provide a polymerized lipid membrane which extends the longevity and durability of lipid bilayers used in biosensors. It is another object of this invention to provide a device which is portable and can be used in the field. Another object of the present invention is to provide a quick and easy method for producing rugged biochemical sensors. These and other objects are achieved by extracting membrane proteins

from biological cells, reincorporating the proteins into a lipid bilayer contacting the bilayer, containing the membrane proteins with the environment containing the stimulus, and measuring the change in voltage or conductivity across the bilayer. The voltage or conductivity change indicates the presence of the stimulus and the magnitude of the voltage or conductivity change indicates the amount of the stimulus present. The polymerized lipid membrane provides a rugged support for the proteins that function to sense molecules in the external environment. The acetylcholine receptor protein is purified by affinity chromatography reincorporated into lipid vesicles of polymerized lipids, and mounted on a glass microelectrode to produce a lipid bilayer containing the reincorporated proteins. One electrode from the silver-silver chloride pair is mounted on each side of the bilayer. The electrodes can measure the change in current across the bilayer when the acetylcholine receptor protein is effected by cholinergic agonists.

GRA

**N86-25975#** Department of the Navy, Washington, D. C.  
**MAGNETIC SEPARATION DEVICE Patent Application**  
 G. M. STARKEN, J. CAVIN, R. A. QUINNELL, C. A. TWIGG, and D. P. CRAWFORD, inventors (to Navy) 25 Sep. 1985 28 p refs  
 (AD-D012163; US-PATENT-APPL-SN-780123) Avail: NTIS HC A03/MF A01 CSCL 06L

This invention pertains to magnetic separation devices and more particularly to; magnetic separation devices used to selectively remove magnetic bead-coated cells from tissues such as bone marrow or blood. Depletion of cell populations from boner marrow has been mainly approached using antibodies conjugated to toxins such as ricin or with antibodies complement to effect lysis of the target cells. These techniques have several disadvantages including difficulty in measuring the selective cell kill in the marrow, non-specific toxicity of either toxins or complement, and the necessity to prepare large amounts of complement. In addition, many antibodies are neither cytotoxic with complement nor toxin conjugates. Polymeric microspheres conjugated to antibodies have been used to probe the cell surface for receptor sites using scanning electron microscopy. Iron-containing polymeric microspheres tagged with fluorescent dyes conjugated to antibodies were used to separate red blood cells and lymphoid cells by binding the antibody-microsphere to selected cells and exposing the cell population to a magnetic field. Over 99% of the bound cells were attracted by the magnet.

GRA

**N86-25976#** Ottawa Univ. (Ontario). Dept. of Electrical Engineering.  
**STUDIES OF THE ELECTRIC FIELD DISTRIBUTION IN BIOLOGICAL BODIES. EXPERIMENTAL DOSIMETRY AT RADIOFREQUENCIES Final Report, Dec. 1981 - Sep. 1985**  
 S. S. STUCHLY and M. A. STUCHLY 5 Dec. 1985 70 p refs  
 (Contract N00014-82-G-0011)  
 (AD-A163156) Avail: NTIS HC A04/MF A01 CSCL 06R

The objective of the project was to develop and evaluate a computer-controlled system for measurements of the spatial distribution of the specific absorption rate (SAR) in biological bodies and to perform measurements on a model of the human body, with particular emphasis on exposures in the near-field of antennas. Far-field exposures at frequencies above 160 MHz, in spite of large gradients, local values of the SAR are only about 20 times higher than the whole-body average SAR for homogeneous models of human body. However, an additional increase by a factor of 4 to 5 can be anticipated at interfaces of high water content tissues with air (gas) pockets and low water content tissues. The existence of large gradients and high local SARs, as confirmed by our results, further supports an accepted view that biological effects at relatively low average SARs are due to thermal interactions. For humans, high SARs occur in the neck, and the ratio of the SAR in the neck to the whole-body average increases with frequency. Near-field exposures, based on the experimental findings we believe that because of the spatial pattern of energy deposition, the whole-body average SAR is not an adequate dosimetric measure for near-field exposures.

GRA

**N86-25977#** Los Alamos National Lab., N. Mex.

#### **DNA ANALYSIS OF EPITHELIAL CELL SUSPENSIONS**

J. S. WILSON, N. F. JOHNSON, and L. M. HOLLAND 1985 22 p refs Presented at the Hanford Life Sciences Symposium, Richland, Wash., 21 Oct. 1985  
 (Contract W-7405-ENG-36)  
 (DE86-002403; LA-UR-85-3568; CONF-8510225-1) Avail: NTIS HC A02/MF A01

Cell suspensions of skin were obtained by animals exposed by skin painting of several crude oils. DNA analysis of these cell suspensions labeled with mithramycin provide determination of percentages of cells in the G1, S and G2M phases of the cell cycle. Data acquired showed differences from control animals occurring as early as 7 days after treatment and persisting through 21 days afterwards. There was histological evidence of erythema and hyperplasia in shale oil-exposed skins. Flow cytometric analysis of DNA content in shale-oil-exposed skin cells showed an increased percentage of cycling cells plus evidence of aneuploidy. Similar data from simply abraded skin showed increased percentages of cycling cells, but no aneuploidy. The shale-oil-exposed group, when compared to a standard petroleum-exposed group, had significantly increased percentages of cycling cells. This early indication of differing response to different complex mixtures was also seen in long-term skin exposures to these compounds. Similar analytical techniques were applied to tracheal cell suspensions from ozone-exposed rats.

DOE

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### AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

#### **A86-33754**

#### **COMPARISON OF HUMAN IMPACT RESPONSE IN RESTRAINT SYSTEMS WITH AND WITHOUT A NEGATIVE G STRAP**

B. F. HEARON and J. W. BRINKLEY (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, April 1986, p. 301-312. refs  
 (Contract F33615-79-C-0523)

The effect of a negative G strap on restraint dynamics and human impact response was evaluated in forward-facing (-Gx) and vertical (+Gz) impact tests performed under different test conditions. In both axes, the experimental exposure was an approximate half-sine waveform, with peak acceleration up to 10 G and velocity change up to 9.2 m/s. Subjects were restrained to the test vehicle using either the PCU-15/P torso harness and lap belt (used operationally in such aircraft as the A-20 and F-15), or a conventional double shoulder strap and lap belt configuration, with fixed-length negative G straps incorporated into half of the experiments. Adding the negative G strap to either restraint system had clearly beneficial effects, including a decreased tendency toward submarining in forward-facing impacts, providing better occupant-seat coupling during free falls, and improving vertical impact protection. Conventional double shoulder strap and lap belt restraint provided better forward-facing and vertical impact protection than the PCU-15/P-including configuration.

I.S.

#### **A86-33755**

#### **MILD HYPOXIA AND VISUAL PERFORMANCE WITH NIGHT VISION GOGGLES**

L. L. LEBER, S. N. ROSCOE, and G. M. SOUTHWARD (New Mexico State University, Las Cruces) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, April 1986, p. 318-324. refs

Military night vision goggles (NVGs) are image intensifiers normally used when the human operator's visual capabilities are unimpaired by oxygen deprivation. However, mountain search team

members and aviators sometimes operate with NVG augmentation of altitudes where hypoxic visual decrement is documented. The objective of this research was to investigate the effects of mild hypoxia on monocular visual performance with NVGs. It was found that mild oxygen deprivation significantly affects unaided square-wave grating visual acuity but does not significantly affect NVG-augmented performance. Large differences between visual sensitivities at different spatial frequencies were not differentially affected by mild hypoxia. Supplemental oxygen did significantly improve naked-eye but not NVG-augmented night resolution acuity up to a simulated altitude of 13,000 ft (3,962 m) above sea level (ASL). Author

**A86-33756\*** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

**EFFECT OF SIMULATED WEIGHTLESSNESS ON EXERCISE-INDUCED ANAEROBIC THRESHOLD**

V. A. CONVERTINO, G. M. KARST, C. R. KIRBY, and D. J. GOLDWATER (NASA, Kennedy Space Center; Bionetics Corp., Cocoa Beach, FL; NASA, Ames Research Center, Moffett Field, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, April 1986, p. 325-331. refs

The effect of simulated weightlessness, induced by ten days of continuous bedrest (BR) in the -6 deg head-down position, on the exercise-induced anaerobic threshold (AT) was determined by comparing specific ventilatory and gas-exchange measurements during an incremental ergometer test performed before and after BR. The primary index for determining the exercise-induced AT values of each subject was visual identification of the workrate or oxygen uptake (VO<sub>2</sub>) at which the ratio of the expired minute ventilation volume (VE) to VO<sub>2</sub> exhibited a systematic increase without a concomitant increase in the VE/VCO<sub>2</sub> value. Following BR, the mean VO<sub>2</sub>max of the subjects decreased by 7.0 percent, and the AT decreased from a mean of 1.26 L/min VO<sub>2</sub> before BR to 0.95 L/min VO<sub>2</sub> after BR. The decrease in AT was manifested by a decrease in both absolute and relative workrates. The change in AT correlated significantly with the change in plasma volume but not with the change in VO<sub>2</sub>max. The results suggest that the reduction in AT cannot be completely explained by the reduction in VO<sub>2</sub>, and that the AT decrease is associated with the reduction in intravascular fluid volume. I.S.

**A86-33757**

**SYSTOLIC TIME INTERVALS IN PILOTS AND NON-PILOTS DURING 70 DEG HEAD-UP TILT**

M. B. DIKSHIT, P. K. BANERJEE, P. L. N. RAO, and E. M. IYER (Indian Air Force, Institute of Aviation Medicine, Bangalore, India) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, April 1986, p. 332-335. Research supported by Armed Forces Medical Services of India. refs

Nine highly experienced Indian fighter pilots in current flying practice and 11 healthy nonpilots underwent head-up tilt (HUT) to 70 deg for 20 min. Heart rate and blood pressure response to tilt stress was similar in the two groups, as was the contractile function of the left ventricle measured by systolic time intervals. The highest prejection period/left ventricular ejection time ratio of 0.402 seen at the end of HUT was considerably lower than the values seen in studies of Grayboys et al. (1974) and Stafford et al. (1970). This suggests that myocardial contractility of Indians adjusts better to tilt stress than that of western subjects not adapted to heat. Author

**A86-33758\*** California Univ., Berkeley.

**ADAPTED HEAD- AND EYE-MOVEMENT RESPONSES TO ADDED-HEAD INERTIA**

G. M. GAUTHIER, B. J. MARTIN, and L. W. STARK (California, University, Berkeley) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, April 1986, p. 336-342. refs (Contract NCC2-86; CNRS-ERA-272)

Adaptation to inertia added to the head was studied in men by mounting masses on a rigidly attached helmet until two- to ten-fold increases of inertia were produced, while an overhead suspension compensated for the weights. The observed changes in the eye

and head movement coordination included increased head movement latencies, as well as changes in the eye movement amplitude, and later stabilizing alternate contractions of the neck muscles. Oscillopsia, or continual displacement or instability of the visual world, which is a symptom of a breakdown of space constancy, was prominent and consistent in the perceptual reports of the subjects. Although adaptation resulting from adding inertia to the head occurred much faster than that induced by adding prisms or lenses, it has similar perceptual and motor components that may be objectively studied in detail. I.S.

**A86-33759\*** Brandeis Univ., Waltham, Mass.

**SUDDEN EMESIS FOLLOWING PARABOLIC FLIGHT MANEUVERS IMPLICATIONS FOR SPACE MOTION SICKNESS**

J. R. LACKNER (Brandeis University, Waltham, MA) and A. GRAYBIEL (U.S. Navy, Naval Aerospace Medical Research Laboratory, Pensacola Naval Air Station, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, April 1986, p. 343-347. refs (Contract NAS9-15147)

Episodes of emesis unaccompanied by the usual prodromal signs of motion sickness have been reported by astronauts in the Space Shuttle program. Such reports have raised the issue whether space motion sickness has different characteristics from terrestrial motion sickness. Evidence is presented here from parabolic flight experiments that sudden vomiting can occur in response to a provocative vestibular stimulus even when no premonitory symptoms are being experienced. Accordingly, in chronic exposure conditions, the absence of prominent signs or symptoms of motion sickness does not necessarily mean an absence of sensitization. Author

**A86-33760**

**ANALYSIS OF THE POTENTIAL ASSOCIATION BETWEEN NOISE-INDUCED HEARING LOSS AND CARDIOVASCULAR DISEASE IN USAF AIRCREW MEMBERS**

S. J. KENT, H. E. VON GIERKE, and G. D. TOLAN (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH; USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, April 1986, p. 348-361. refs

The purpose of this investigation was to explore the relationship between noise-induced hearing loss and cardiovascular disease by examining the medical records of 2250 Air Force aircrew members. In this correlative analysis, high-tone hearing loss diagnosed with a high probability of being noise-induced was interpreted as an indirect indicator of noise exposure. Cardiovascular function was measured in terms of recorded systolic and diastolic blood pressure and clinical diagnoses of cardiovascular diseases. Analyses consisted of comparing cardiovascular parameters in maximum and minimum hearing loss groups, including polynomial regression curves for blood pressure data, and determining relative risk and attributable risk associated with noise-induced hearing loss for development of cardiovascular disease. The analyses consistently failed to indicate any association between the degree of noise-induced hearing loss and cardiovascular function in the aircrew population. Author

**A86-33762**

**SYSTOLIC BLOOD PRESSURE IN FIGHTER PILOTS AFTER 12-15 YEARS SERVICE**

P. FROMM, M. GROSS, J. BARZILAY, D. F. FORECAST, S. MARGALIT (Israel Air Force, Aeromedical Centre, Tel Hashomer; Hadassah University Hospital, Jerusalem, Israel) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, April 1986, p. 367-369. refs

Systolic blood pressure (SBP) was measured at entry and after 12-15 years in 112 fighter pilots and compared to 112 transport and helicopter pilots. The pilots were 20-24 years old on entry into the study. Mean SBP + or - 1 S.D on entry was 122 + or - 12 mm Hg in fighter pilots and 124 + or - 12 mm Hg in transport and helicopter pilots. After 12-15 years follow-up, the mean SBP was 118 + or - 12 mm Hg in both groups. It is concluded that

the stress of flying fighter aircraft for 12-15 years is not associated with an increased risk of hypertension. Author

#### A86-33763

##### RETROSPECTIVE ANALYSIS OF NAVAL SPECIAL BOARDS OF FLIGHT SURGEONS, 1974-83

W. D. LOVAN, R. A. WEAVER, R. J. LENTZ, J. K. GOODRUM, and B. F. WITHERS, III (U.S. Navy, Naval Aerospace Medical Institute, Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, April 1986, p. 370-375. refs

The Naval Special Board of Flight Surgeons (SBFS) was established in 1956 for the evaluation of Navy, Marine Corps, and Coast Guard problem aeromedical cases. This paper examines a sample consisting of 248 of these cases for the period of 1974-83 with respect to the characteristics of those referred, their referral diagnostic category, and the recommendation of the Special Board regarding return to a flying status. Those cases with a referral diagnostic category of ENT and Ophthalmology were less likely to be returned to flight status. Older, more senior pilots, and pilots with more total flight time were less likely to be returned to unrestricted flying than were their younger, more junior, and less experienced counterparts. Otherwise, no significant difference in outcome based on age, rank, marital status, branch of service, specialty, or flight hours was detected. Overall, 61 percent of those evaluated by the SBFS were returned to flight status.

Author

#### A86-33801

##### ZONAL DIFFERENTIATION OF PERFORMANCE UNDER HEAT STRESS

P. A. HANCOCK and A. A. BEHNKE (Southern California, University, Los Angeles, CA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 585-589. refs

This paper details four discrete zones which describe the limit of human physiological and performance capabilities in conditions of elevated environmental temperature. Boundaries to these zones are expressed in both environmental and physiological parameters. The practical application of these zones may be realized where individuals are exposed to continuous or intermittent heat stress.

Author

#### A86-33838

##### NONIONIZING RADIATION DAMAGE IN THE EYE

R. L. MCCALLY, R. A. FARRELL, C. B. BARGERON, H. A. KUES, and B. F. HOCHHEIMER (Johns Hopkins University, Laurel, MD) Johns Hopkins APL Technical Digest (ISSN 0270-5214), vol. 7, Jan.-Mar. 1986, p. 73-91. Research supported by the Independent Research and Development Funds, Wilmer Institute, Army, and Navy. refs

Damage mechanisms in corneas exposed to infrared and microwave radiation and retinas exposed to visible light are discussed. A new thermal-damage model for describing threshold damage to the cornea's front cellular layer caused by the absorption of CO<sub>2</sub> laser infrared radiation is discussed, in addition to the healing and repair processes that follow exposure. In the model, damage is associated with the occurrence of a phase transition, and a physical explanation is provided for the small variation in temperature rise observed at the damage threshold condition for different exposure durations. Morphological changes in the cornea's posterior cellular layer induced by exposure to low-level microwave radiation are described, and a new low safe-exposure level for microwaves is suggested. Blue or violet light low-level exposure diagnostic techniques such as retinal photography are found to be inadequate, and new techniques based on the measurement of several fluorescent properties of probe dyes are presented.

R.R.

#### A86-35285#

##### MEDICAL PROBLEMS OF SPACE FLIGHTS

P. C. CHATTERJEE (Indian Air Force, New Delhi, India) Aviation Medicine, vol. 29, June 1985, p. 9-12.

A general introduction to the various environmental stresses on man during space flight has been presented. These can broadly be divided into dynamic, physical and internal elements. Most of the body systems are adversely affected due to weightlessness. Some of the important aspects have been highlighted with requirement of possible prophylactic methods and methods of adaptation.

Author

#### A86-35287#

##### MEDICAL EVALUATION OF COSMONAUTS DURING SPACE FLIGHT AND IMMEDIATE PRE AND POST FLIGHT PERIODS

P. M. SUNDARAM (Indian Air Force, Institute of Aviation Medicine, Bangalore, India) Aviation Medicine, vol. 29, June 1985, p. 18-22.

Procedures and tests performed in the preflight medical evaluation and maintenance, in-flight monitoring, and postflight evaluation of a spacecraft personnel crew that included an Indian cosmonaut are described. The preflight tests included a cardiovascular evaluation (tilt table tests, echocardiogram and electrocardiograms taken at rest and on an ergometer); (2) ophthalmological evaluation (perimeter studies, the adaptometer and the ocular muscle balance tests, and visual acuity studies); (3) vestibular evaluation; (4) dental evaluation; and (5) biochemical tests to serve as the baseline data. In addition to physical exercises, the Indian cosmonauts have carried out daily yoga exercises. The postflight medical evaluation indicated that the preflight medical program was adequate for the purposes of selection and training for flight missions.

I.S.

#### A86-35288#

##### VECTORCARDIOGRAPHIC STUDIES DURING INDO-SOVIET JOINT SPACE PROJECT

B. R. S. REDDY, G. S. NAYAR (Indian Air Force, Institute of Aviation Medicine, Bangalore, India), and P. C. CHATTERJEE (Indian Air Force, New Delhi, India) Aviation Medicine, vol. 29, June 1985, p. 23-30. refs

This paper presents the results of one of the first in-flight vectorcardiographic (VCG) studies along with preflight and postflight records. VCG data from two cosmonauts were recorded before, during, and after flight, while at rest and also during and after exercise on a bicycle ergometer. There was an increase in size of in-flight VCG loops and a decrease during the postflight period with recovery within four days. Short duration weightlessness did not have any negative effect on the functional state of the heart, as evidenced from cardiac vector studies.

Author

#### A86-35290#

##### EVALUATION OF PRECORDIAL MAPPING BEFORE AND AFTER SUBMAXIMAL EXERCISE AMONGST NORMAL AND ASYMPTOMATIC SUBJECTS WITH NON SPECIFIC ST-T ABNORMALITIES

M. M. SINGH (Air Force Central Medical Establishment, New Delhi, India), B. R. S. REDDY (Indian Air Force, Institute of Aviation Medicine, Bangalore, India), J. S. KULKARNI (Air India, Bombay), and S. K. ADAVAL (Command Hospital, Bangalore, India) Aviation Medicine, vol. 29, June 1985, p. 38-42. refs

Using the automatic lead selector device of Reddy et al. (1981) and a conventional ECG machine, 16-point precordial ST-T mapping was conducted, before and after submaximal exercise, on 20 normal subjects, 61 subjects with nonspecific ECG abnormalities, three subjects with chest pain symptoms, and seven subjects with stabilized ischemic heart disease (IHD). The 16-point mapping helped to correctly diagnose ST-T changes in 71.4 percent of the IHD group. In contrast, this procedure ruled out IHD in 95.1 percent of the group with nonspecific ECG abnormalities. The observed ST-T changes were frequently seen in the No. 11 to No. 16 points of the maps.

I.S.



A86-35291#

**RESPIRATORY DISEASES - AEROMEDICAL ASPECTS INCLUDING DISPOSAL**

J. S. KULKARNI (Air India, Bombay) Aviation Medicine, vol. 29, June 1985, p. 51-55.

Physiological determinants used in evaluating pilots for flying fitness are discussed. Special consideration is given to testing tolerance to respiratory stress due to environmental hypoxia and to Gz and Gx accelerations, as well as to diagnosing functional defects of the respiratory system. The respiratory indices used in differentiating between various types of ventilation defects (obstructive and nonobstructive) and of diffusion defects (due to pneumonia, asthma, pleural effusion, chronic bronchitis, emphysema, and pulmonary fibrosis) are described. Sixteen subjects with respiratory diseases, diagnosed in the course of an evaluation performed on 1445 subjects at the Institute of Aviation Medicine, were subjected to hypoxia stress and acceleration profile tests. Out of these, only two pilots have been permanently grounded, while four others were put back to full flying duties. It is noted that, in spite of the widespread habit of smoking in the Air Force, no cases of chronic bronchitis with emphysema have been detected. I.S.

A86-36219

**CUTANEOUS VASCULAR RESPONSES TO HEAT SIMULATED AT A HIGH ALTITUDE OF 5,600 M**

S. SAGAWA, K. SHIRAKI, and N. KONDA (University of Occupational and Environmental Health, Kitakyushu, Japan) Journal of Applied Physiology (ISSN 0161-7567), vol. 60, April 1986, p. 1150-1154. refs

Changes in cutaneous circulation due to hypoxia during simulated high altitude heat exposure are investigated. Six men were placed in an altitude chamber at 5600 m and were subjected to a 60-min heat exposure. After a 60-min equilibrium period at thermoneutrality (28 C), a heat load was provided by an increase in chamber temperature to 38 C at a rate of 1 deg min. Skin blood flow in the forearm (FBF) and finger (FiBF), skin and esophagus temperatures, and cardiac output (CO) were measured during heat exposure at 5,600 m and at sea level, and during the high altitude thermoneutral period. During thermoneutrality, hypoxia increased the mean skin temperature and mean heat transfer coefficient, as well as FBF and forearm vascular conductance, though no alteration in CO or in total peripheral resistance was found. During heat exposure, esophagus temperature rose faster at high altitude than at sea level. However, post-exposure data indicate that with the exception of FiBF, all thermal as well as circulatory parameters were unaffected by altitude. This attenuated vasodilation in the fingers suggests differential vascular controls and possible impairment of thermoregulation when additional stress, such as heat, is imposed. It can be concluded that cutaneous vasodilation caused by heat exposure is not induced uniformly over the whole body in a hypoxic environment. K.K.

A86-36222

**TIME COURSE OF MUSCULAR BLOOD METABOLITES DURING FOREARM RHYTHMIC EXERCISE IN HYPOXIA**

J. RAYNAUD, D. DOUGUET, P. LEGROS, A. CAPDEROU, B. RAFFESTIN (Paris XI, Univesite; Centre Chirurgial Marie-Lannelongue, Le Plessis-Robinson, France) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 60, April 1986, p. 1203-1208. Research supported by the Universite de Paris XI; Ministere de la Recherche et de la Technologie of France. refs (Contract MRTF-82,J,0159)

The time course of local muscular metabolism, when arterial afferent blood remains unaltered, was studied. O<sub>2</sub>, concentration, PO<sub>2</sub>, PCO<sub>2</sub>, pH, osmolarity, and lactate, and Hb concentrations in forearm venous blood were measured during the submaximal exercise of forearm muscles. Blood composition was determined at times of rest and exercise; in normoxic and hypoxic environments. In hypoxia the venous muscular blood PO<sub>2</sub> and O<sub>2</sub> concentration was lower at rest and during exercise. The muscular arteriovenous O<sub>2</sub> difference during exercise in hypoxia was increased by 10 pct compared with normoxia, which implies a

similar increase in muscular blood flow, assuming exercise O<sub>2</sub> consumption was not affected by hypoxia. Changes in PCO<sub>2</sub> and pH magnitude were smaller in hypoxia during exercise and recovery, suggesting an increase in reduced Hb. An increase in muscular venous Hb coupled with unaltered arterial blood, poses the possibility of a continuous transcapillary water leakage during the first five minutes of exercise. It is concluded that muscular blood composition is less affected by hypoxia than expected. K.K.

A86-36224

**LOW ACUTE HYPOXIA VENTILATORY RESPONSE AND HYPOXIC DEPRESSION IN ACUTE ALTITUDE SICKNESS**

L. G. MOORE, G. L. HARRISON, R. E. MCCULLOUGH, R. G. MCCULLOUGH, A. J. MICCO (Colorado, University, Denver; Colorado State University, Fort Collins) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 60, April 1986, p. 1407-1412. refs

(Contract NIH-HL-14985)

It is hypothesized that low initial hypoxic ventilatory response and/or subsequent greater blunting by hypocapnia or prolonged hypoxia would lower ventilation at high altitude in symptomatic compared to asymptomatic individuals. Eight subjects with histories of acute altitude sickness were compared with four subjects who had been asymptomatic during prior altitude exposure. At a simulated altitude of 4800 m, the susceptible group developed symptoms of altitude sickness and had lower minute ventilations and higher end-tidal PCO<sub>2</sub> than the asymptomatic subjects. In measurements made prior to altitude exposure, ventilatory responsiveness to hypoxia was reduced in symptomatic compared to asymptomatic subjects, under both isocapnic and and poikolocapnic conditions. Diminution of the poikolocapnic relative to the isocapnic hypoxic response was similar in both groups, characterized by a ventilation decrease and an end-tidal PCO<sub>2</sub> increase. It is concluded that hypoventilation in symptomatic compared to asymptomatic subjects is greater as a result of both a lower acute hypoxic response and a subsequent greater blunting of ventilation at high altitude. K.K.

A86-36309

**HEMODYNAMIC RESPONSE TO LBNP FOLLOWING 2 HOURS HDT (-6 DEG)**

H. LOELGEN, K. E. KLEIN, U. GEBHARDT, J. BEIER, J. HORDINSKY (DFVLR, Institut fuer Flugmedizin, Cologne; Freiburg, Universitaet, Freiburg im Breisgau; Bonn, Universitaet, West Germany) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, May 1986, p. 406-412. refs

Central hemodynamics have been determined during stepwise decreasing lower body pressure in head-down tilt of -6 deg. Measurements were performed on eight healthy volunteers using right heart catheterization. During lower body negative pressure (LBNP), pressures in the right atrium, pulmonary artery, and pulmonary capillary (preload) decreased in parallel with the increase of negative pressure applied to the lower part of the body. Similarly, stroke volume and cardiac output decreased with increasing negative pressure. Heart rate moderately increased (30 percent) as well as total peripheral resistance. The left ventricular function curve was shifted downward and to the left during LBNP indicating hypovolemia with no evidence of decreased contractility. Cardiac dimensions determined by echocardiography changed in a similar way as those obtained by invasive measurements. There was a very close correlation between stroke volume determined by thermodilution and by echocardiography. Plasma norepinephrine and dopamine tended to increase at the end of LBNP. Echocardiography proved a useful and reliable approach to hemodynamic measurement during LBNP and is recommended for analysis of hemodynamic parameters during zero G and Gz simulation. Author

**A86-36310\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**CARDIOVASCULAR DYNAMICS ASSOCIATED WITH TOLERANCE TO LOWER BODY NEGATIVE PRESSURE**

T. M. SATHER, D. J. GOLDWATER, L. D. MONTGOMERY (NASA, Ames Research Center, Moffett Field, CA; Arizona, University, Tucson), and V. A. CONVERTINO (Bionetics Corp., Cocoa Beach, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, May 1986, p. 413-419. refs

The purpose of this investigation was to identify cardiovascular responses associated with tolerance to lower body negative pressure (LBNP). Eighteen men, ages 29-51 years, were categorized as high (HT) or low (LT) LBNP-tolerant based on a graded presyncopal-limited LBNP exposure criterion of -60 mm Hg relative to ambient pressure. Groups were matched for physical characteristics and pre-LBNP cardiovascular measurements, with the exceptions of greater ( $p$  less than 0.05) end-diastolic volume and cardiac output in the HT group. During peak LBNP, cardiac output was similar in both groups, although the HT group displayed a greater heart rate ( $p$  less than 0.05). In both groups, venous return appeared to limit cardiac output resulting in decreased arterial pressure. Tolerance to LBNP did not appear solely dependent on the absolute amount of blood pooled in the legs since the HT group demonstrated a greater ( $p$  less than 0.05) peak LBNP-induced increase in midthigh-leg volume. Greater tolerance to LBNP was associated with a larger pre-LBNP cardiac output reserve and higher compensatory increases in heart rate and peripheral resistance. Author

**A86-36311\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**EFFECT OF HYDRATION ON PLASMA VASOPRESSIN, RENIN, AND ALDOSTERONE RESPONSES TO HEAD-UP TILT**

M. H. HARRISON, G. GEELEN, L. C. KEIL, C. A. WADE, L. C. HILL (NASA, Ames Research Center, Moffett Field; Letterman Army Institute of Research, San Francisco, CA) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, May 1986, p. 420-425. refs

If plasma vasopressin (PVP), plasma renin (PRA), and plasma aldosterone (PA) responses to change in posture are mediated only by alterations in intrathoracic baroreceptor activity hydration status should have minimal influence on these responses. To test this hypothesis, six male subjects underwent 45 min of 70 deg head-up tilt (HUT) following 26 h dehydration, and again, 105 min later, following rehydration. Compared with preceding supine hydrated control values, PVP, PRA, and PA increased ( $p$  less than 0.001) during dehydrated HUT, but only PVP and PRA increased during rehydrated HUT ( $p$  less than 0.001). The dissociation during rehydrated HUT of PRA and PA may have been related more to the reduction ( $p$  less than 0.001) in plasma potassium concentration than to the accompanying decrease ( $p$  less than 0.001) in plasma osmolality and sodium concentration. Although increases in PVP and PRA during HUT were attenuated ( $p$  less than 0.01) following rehydration, this attenuation was associated with the absence of symptoms of overt hypotension following rehydration. However, since rehydration did not abolish the increases in PVP and PRA induced by HUT, it is concluded that the present observations support the concept of intrathoracic baroreceptor involvement in the regulation of vasopressin secretion and renin release. Author

**A86-36312\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**PLASMA VISCOSITY ELEVATIONS WITH SIMULATED WEIGHTLESSNESS**

D. G. MARTIN, V. A. CONVERTINO, D. GOLDWATER, E. W. FERGUSON, and E. B. SCHOOMAKER (NASA, Ames Research Center, Moffett Field, CA; Uniformed Services University of the Health Sciences, Bethesda, MD; Arizona, University, Tucson) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, May 1986, p. 426-431. refs

A hypothesis correlating an increase in blood viscosity during bed rest to a decrease in aerobic capacity during simulated

weightlessness is tested. Eight human subjects were studied on the sixth day of bed rest during two consecutive 10-d bed rest periods separated by a 14-d recovery interval designed to simulate the flight-layover schedule of Shuttle astronauts. Plasma viscosity and volume were measured, together with maximal aerobic capacity (VO<sub>2</sub>max). An increase in hematocrit, plasma protein, and fibrinogen concentrations was found, contributing to an elevation in plasma viscosity. VO<sub>2</sub>max decreased significantly in the first, but not the second bed rest cycle, and though many individuals exhibited a decrease in plasma volume and aerobic capacity coupled with elevated plasma viscosity, correlations between these variables were lacking. It is concluded that the decrease in VO<sub>2</sub>max observed following simulated weightlessness cannot be attributed to alterations in muscle blood flow resulting from increased blood viscosity. K.K.

**A86-36313**

**INFLUENCE OF INSPIRED OXYGEN CONCENTRATION ON ACCELERATION ATELECTASIS**

M. S. HASWELL, W. A. TACKER, JR., U. I. BALDIN, and R. R. BURTON (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, May 1986, p. 432-437. refs

The USAF is developing an On Board Oxygen Generation System (OBOGS) for use in fighter aircraft. This study was conducted to determine the inert gas dilution requirements of the OBOGS necessary to prevent acceleration atelectasis. Human subjects were exposed to either 21, 50, 70, 82.5, 95 or 100 percent inspired oxygen, along with an increased +Gz Simulated Aerial Combat Maneuver (SACM) profile using a human centrifuge. The SACM profile utilized four +4.5z peaks (136 s at this +Gz) superimposed on a +3 Gz baseline, representing a total ride time of 276 s. A significant reduction in vital capacity (VC) occurred at inspired oxygen concentrations of 70 percent and greater. The addition of 5 percent argon (a natural product of OBOGS) to pure oxygen did not reduce the magnitude of acceleration atelectasis observed, nor the severity of breathing symptoms. A 30-s exposure to positive pressure breathing at 30 mm Hg during the end of the SACM reduced the level of VC reduction caused by subjects breathing 100 percent oxygen during +Gz. Author

**A86-36314**

**LONGITUDINAL STUDY OF CARDIOVASCULAR DISEASE IN U.S. NAVY PILOTS**

A. HOIBERG (U.S. Navy, Naval Health Research Center, San Diego, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, May 1986, p. 438-442. refs

This longitudinal study examined the consequences of cardiovascular disease (CVD) in 145 U.S. Navy pilots who suffered a CVD incident during the 1972-79 time period. Results showed that one pilot died, one suffered a second acute myocardial infarction, and 32 pilots were hospitalized and/or retired with a physical disability because of CVD. The majority of subsequent CVD incidents occurred during a 12-month period after the initial CVD event; 35 percent had discontinued flying prior to the initial CVD incident. Percentages of pilots who either remained on active duty or were separated for nonmedical reasons ranged from 64.3 percent for pilots in the chronic ischemic heart disease sample to 97.6 percent for the symptomatic heart disease group. Thus, the majority of pilots were returned to duty either after the initial CVD incident or subsequent to the rehospitalization or physical evaluation board. Author

**A86-36315\*** Brandeis Univ., Waltham, Mass.

**HEAD MOVEMENTS IN NON-TERRESTRIAL FORCE ENVIRONMENTS ELICIT MOTION SICKNESS - IMPLICATIONS FOR THE ETIOLOGY OF SPACE MOTION SICKNESS**

J. R. LACKNER and A. GRAYBIEL (Brandeis University, Waltham, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, May 1986, p. 443-448. refs (Contract NAS9-15147)

Space motion sickness has become an operational concern in manned space flight. Considerable evidence exists that head



movements in free fall, especially pitch movements, are provocative until adaptation occurs. The question arises whether space motion sickness is an unique nosological entity or is due to body movements in a nonterrestrial force environment, a force environment for which the body's dynamic sensory-motor adaptations to 1 G are no longer appropriate. To evaluate this issue, subjects were asked to make controlled head movements during exposure to high gravito-inertial force levels, 1.8-2.0 G, in parabolic flight maneuvers. Head movements in pitch with eyes open were most evocative of motion sickness, yaw movements with eyes covered were least provocative. This pattern is identical to that which occurs when the same types of head movements are made in the free fall phase of parabolic maneuvers. It appears that space motion sickness is the consequence of prolonged exposure to a nonterrestrial force background rather than of exposure to free fall per se. Author

**A86-36317**  
**CENTRAL SEROUS RETINOPATHY (CHOROIDOPATHY) IN PILOTS**

M. GROSS, P. FROOM, Y. TENDLER, M. MISHORI, and J. RIBAK (Israel Air Force, Aeromedical Center, Ramat Gan) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, May 1986, p. 457, 458. refs

The clinical charts of pilots in the Israeli Airforce were reviewed retrospectively for evidence of central serous retinopathy (CSR). There were 14 pilots with documented CSR identified, with an incidence of 1.3 per 1000 per year. Of six pilots who had recurrent attacks, five had a decrease of visual acuity during the initial attack to at least 20/30 in the affected eye. On the other hand, in those with visual acuity no worse than 20/25, only one of seven had recurrent attacks (p less than 0.05). It is concluded that CSR is a common condition in pilots, and that visual acuity during the initial attack can predict those who will have recurrent disease. Author

**A86-36495**  
**A STUDY OF THE EFFECT OF ULTRASOUND ON THE ANTIGENIC ACTIVITY OF HUMAN ERYTHROCYTES [ISSLEDOVANIIE DEISTVIA UL'TRAZVUKA NA ANTIGENNUIU AKTIVNOST' ERITROTSITOV CHELOVEKA]**

L. A. PIRUZIAN, R. G. MAEV, M. M. NISNEVICH, M. M. KOIFMAN, and Z. N. KORNEVA (AN SSSR, Institut Khimicheskoi Fiziki, Moscow, USSR) Biofizika (ISSN 0006-3029), vol. 31, Mar.-Apr. 1986, p. 269-273. In Russian. refs

**A86-36526**  
**HEART AND RESPIRATION RATES DURING A MENTAL TASK PERFORMED WITH VARYING DEGREES OF SUCCESS [CHASTOTA SERDECHNYKH SOKRASHCHENII I DYKHANIIA PRI RAZLICHNOI USPESHNOSTI VYPOLNENIIA UMSTVENNOI RABOTY]**

T. M. SINITSINA (Leningradskii Nauchno-Issledovatel'skii Institut Neurokhirurgii, Leningrad, USSR) and R. P. CHEKURDA Fiziologiya Cheloveka (ISSN 0131-1646), vol. 12, Mar.-Apr. 1986, p. 199-203. In Russian. refs

The effect of the degree of achievement in performing a mental assignment on the rates of respiration (RR) and heart contraction (HCR) was studied in 49 men and women by continually measuring the rates before, during, and after a mental test that required strict attention. The increases in RR and HCR were seen to parallel the degree of nervous tension and were highest among the poorest achievers. Correlation between the changes in the RR and HCR varied with the level of achievement: among the best achievers, the correlation ratio was in the range of 0.62-0.65, while in the lowest achievers there was no correlation. The results support the report of Zagriadskii and Sulimo-Samuillo (1982) that the optimal regulation of physiological functions facilitates ability to adapt to stressful situations. I.S.

**A86-36528**

**THE MECHANISMS OF MUSCLE ACTIVITY REGULATION IN HUMANS DEPENDING ON BIORHYTHM TYPE [MEKHANIZMY REGULATSII MYSHECHNOI DEIATEL'NOSTI V ZAVISIMOSTI OT BIORITMOLOGICHESKOGO TIPA CHELOVEKA]**

S. G. KRIVOSHCHIEKOV, G. M. DIVERT, and G. M. DOMAKHINA (Institut Fiziologii, Novosibirsk, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 12, Mar.-Apr. 1986, p. 258-262. In Russian. refs

The functional states of the central nervous system (CNS) and of the muscles were assessed in the morning and evening hours in subjects of three biorhythm types: the evening and the morning types, and the arrhythmics. The subjective work capacity (SWC) levels were determined from questionnaires. In all subjects, the SWC levels correlated well with the functional muscle activity determined from electromyographic indices, being maximal in the morning for the morning types, and in the evening for the evening types. In subjects of the morning type, the maximal and minimal values of the SWC also coincided with the highs and lows of the sensorimotor reaction speeds (i.e., with the functional state of the CNS), whereas in the evening types and in the arrhythmics such synchrony was absent. It is suggested that, in the morning types, the psychophysiological synchrony is psychogenically determined by the CNS regulatory mechanism, which is disturbed in subjects of the evening type due to socially acquired changes in the activity rhythms. I.S.

**A86-36529**

**SEASONAL DYNAMICS OF CIRCADIAN RHYTHMS OF OXYGEN CONSUMPTION AND HEAT PRODUCTION IN YOUTHS IN SIBERIAN CONDITIONS [SEZONNAIA DINAMIKA SUTOCHNYKH RITMOV POTREBLENIIA KISLORODA I TEPLOPRODUKTSII U PODROSTKOV V USLOVIIAKH SIBIRI]**

N. D. NEDBAEVA (Institut Fiziologii, Novosibirsk, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 12, Mar.-Apr. 1986, p. 263-268. In Russian. refs

**A86-36530**

**THE DYNAMICS OF SYSTEMIC FUNCTIONAL ORGANIZATION DURING ADAPTATION TO WORK IN EXTREME ENVIRONMENTS [DINAMIKA SISTEMNOI ORGANIZATSII FUNKTSII PRI ADAPTATSII K TRUDU V EKSTREMAL'NYKH USLOVIIAKH]**

V. P. GREBNIAN and E. I. CHUPRINA (Donetskii Nauchno-Issledovatel'skii Institut Gigeny Truda i Profzabolevanii, Donetsk, Ukrainian SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 12, Mar.-Apr. 1986, p. 269-276. In Russian. refs

Dynamics of systemic organization were studied in miners working under stressful environmental conditions, using the maximal correlation method of Terentiev (1959). The correlation matrix included parameters of age, length of professional service, and the professionally significant stress indices of the cardiovascular, respiratory, and circulatory systems. It was found that the correlation coefficients between the systemic physiological indices were most informative in subjects with 2-5 yrs of stressful work experience. Whereas the number of intersystemic shifts was maximal in subjects with 2-5 years experience, the intrasystemic shifts continued to increase with the years of service. I.S.

**A86-36531**

**EVALUATING THE FUNCTIONAL STATUS OF OPERATORS USING INDICES OF MENTAL WORK CAPACITY [OTSENKA FUNKTSIONAL'NOGO SOSTOIANIIA OPERATOROV PO POKAZATELIAM UMSTVENNOI RABOTOSPOSOBNOSTI]**

A. I. U. BUROV (Kievskii Nauchno-Issledovatel'skii Institut Gigeny Truda i Profzabolevanii, Kiev, Ukrainian SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 12, Mar.-Apr. 1986, p. 281-288. In Russian. refs

Results of psychophysiological tests were used to establish correlators between mental work capacity and vegetative indices. The latent time in answering questions and the number of correct answers in the test were correlated with the ECG R-R

cardiointervals, the propagating time of the pulse waves (RPs), and the cutaneous galvanic reaction recorded during the test. The character of vegetative activity was found to correlate with the capacity to do mental work, especially with the work productivity. The period between 1 and 15 min in the recorded spectra was found to be most useful for the psychophysiological assessment. I.S.

#### A86-36532

### **SUBSTANTIATION OF PHYSIOLOGICAL CRITERIA FOR ASSESSING THE FUNCTIONAL STATUS OF THE HUMAN BODY IN HIGH-TEMPERATURE ENVIRONMENTS [OBOSNOVANIIE FIZIOLOGICHESKIKH KRITERIEV DLIYA OTSENKI FUNKSIONAL'NOGO SOSTOYANIYA ORGANIZMA CHELOVEKA V USLOVIYAKH VYSOKIKH TEMPERATUR OKRUZHAIUSHCHEI SREDY]**

A. N. AZHAEV Fiziologiya Cheloveka (ISSN 0131-1646), vol. 12, Mar.-Apr. 1986, p. 289-295. In Russian. refs

The value of the parameters of water and ion exchange and thermal exchange processes and of cardiovascular and respiratory systems for assessing the ability of the human body for thermal adaptation was studied. Male subjects were exposed to temperatures in the 20-80 C range for various times. While the informational value of all the parameters studied depended on the degree of overheating, the parameters derived from the measurements of skin and rectal body temperatures were found to be useful in the assessment of the human functional state under all degrees of overheating. Under the conditions causing the first degree of overheating, the heat exchange rate, the loss of body weight, heat loss through perspiration, and the mean of skin temperature were found to be the most significant correlants. In the second and third overheating degrees, rectal temperature changes, and the parameters of the cardiovascular and respiratory functions were most informative. I.S.

#### A86-36533

### **MANGANESE METABOLISM IN HEALTHY HUMANS DURING DIFFERENT TIMES OF THE YEAR [OBMEN MARGANTSIA U ZDOROVYKH LIUDEI V RAZNOE VREMIA GODA]**

V. V. NASOLODIN and V. IA. RUSIN (Iaroslavskii Gosudarstvennyi Universitet, Yaroslavl, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 12, Mar.-Apr. 1986, p. 322-327. In Russian. refs

#### A86-36534

### **DYNAMICS OF THE ULTRASLOW BIOELECTRIC BRAIN ACTIVITY DURING THE PERFORMANCE OF CERTAIN PARTS OF OPERATIONAL ACTIVITY [DINAMIKA SVERKHMEDLENNOI BIOELEKTRICHESKOI AKTIVNOSTI MOZGA PRI REALIZATSII NEKOTORYKH ELEMENTOV OPERATORSKOI DEIATEL'NOSTI]**

V. I. PRIMAKOV (Voenno-Meditsinskaya Akademiya, Leningrad, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 12, Mar.-Apr. 1986, p. 328, 329. In Russian. refs

The degree of correlation between the ultraslow electrical brain activity with the functional state of an operator was investigated in subjects before and during the performance of various psychomotor and psychophysiological tests. Changes in the amplitude and period characteristics of the zeta and tau waves were recorded during videomotor acuity tests and during tests evaluating subjects' attention. The characteristics of both zeta and tau activities changed differently during various phases of the operators' activity, demonstrating that the ultraslow brain activity can serve as an objective index for evaluating the degree of strain imposed on the regulatory brain structures that control and rearrange the activity levels in other systems of the body. I.S.

#### A86-36535

### **HUMAN ADAPTATION TO ANTAGONISTIC ENVIRONMENTAL FACTORS [ADAPTATSIYA CHELOVEKA K VOZDEISTVIU ANTAGONISTICHESKIKH FAKTOROV SREDY]**

V. A. ASTASHIN (Voenno-Meditsinskaya Akademiya, Leningrad, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 12, Mar.-Apr. 1986, p. 330, 331. In Russian.

The effect of alternate exposures to low and high temperatures on human physiological reactions was studied in subjects exposed for five days to a regimen of 2 hrs at 16 C and 40 percent humidity, followed by 2 hrs at 49 C and 25 percent humidity. The rate of heart contractions, minute respiratory volume, rectal temperature changes in the sensorimotor reactions, cardiovascular response to physical load, and leukocyte counts were monitored at all stages of the experiment. In addition, the effect of adaptation on the thermoregulatory reactions was studied by subjecting some subjects to an additional test consisting of an exposure to 10 C at rest, followed by exercise at 49 C, conducted before and after the 5-day adaptation experiment. The complex patterns of changes in the physiological reactions of thermoregulation suggest the existence of two simultaneous processes of adaptation. I.S.

#### A86-37077

### **MUSCLE ATROPHY DURING SPACE FLIGHT - RESEARCH NEEDS AND OPPORTUNITIES**

G. J. HERBISON (Thomas Jefferson Hospital, Philadelphia, PA) and J. M. TALBOT (Federation of American Societies for Experimental Biology, Life Sciences Research Office, Bethesda, MD) Physiologist (ISSN 0031-9376), vol. 28, Dec. 1985, p. 520-527. refs

Data on muscle biology and atrophy including causes, preventions, and rehabilitation are examined. Muscle atrophy related to actual and simulated space flight is studied; potential causes of space-flight muscle atrophy and countermeasures are studied. The objectives of NASA's current and planned research programs for space-related muscle atrophy are discussed. I.F.

**N86-25111** National Aeronautics and Space Administration, Washington, D.C.

### **AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 284)**

May 1986 59 p  
(NASA-SP-7011(284); NAS 1.21:7011(284)) Avail: NTIS HC A04 CSCL 06E

This bibliography lists 148 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1986. Author

**N86-25112#** Norwegian Defence Research Establishment, Kjeller. Forsvarets Forskningsinstitutt.

### **CHEMICALLY INDUCED DAMAGE TO THE HIPPOCAMPAL FORMATION**

L. U. NAALSUND May 1986 91 p refs Sponsored in cooperation with the Royal Norwegian Council for Scientific and Industrial Research  
(NDRE/PUBL-86/1002; ISSN-0800-4412) Avail: NTIS HC A05/MF A01

Degeneration of the hippocampal formation after trimethyltin (TMT) administration can be detected at an early phase by electric recordings from intrahippocampal electrodes. The anatomical distribution of the damage can be studied by histochemistry, and was shown to include the CA3 and CA4 subfields in the initial period and spreading to the CA1 after a complete destruction of the pyramidal cells in CA3 and CA4. The degeneration was shown to be specific for glutamergic neurons in the hippocampus, high affinity uptake of 3H glutamate being the only biochemical parameter which was changed. In vitro TMT increased the efflux of 3H glutamate from synaptosomes in the resting state, but had no effect on the efflux of 3H GABA. The synaptosomal reuptake of transmitter and receptor binding were both inhibited in the presence of TMT. In relation to reports on TMT as an anion conductor, the effect of changes in extracellular Cl(-) concentration on transmitter release was investigated. A reduction in the external

Cl(-) concentration was shown to have a much larger effect on the efflux of transmitter from glutamergic than from GABAergic synaptosomes. The sensitivity of the hippocampal electric activity to changes after exposure to toxic compounds was utilized for the investigation of a put active neurotoxic effect of long term exposure to low levels of toluene. An increased synchronization together with an increased frequency in the theta waves was observed during the first period of toluene exposure. The later phase was characterized by a gradually increasing disruption in regular waves and a reduction in the theta frequency. No improvements regarding regularity or frequency was seen during one month after termination of exposure, indicating that irreversible changes in neuronal functions have occurred. Author

**N86-25113#** Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

**A REVIEW OF THE PILOT BACKACHE PROBLEM IN THE CH113 LABRADOR HELICOPTER**

A. BEACH Dec. 1985 26 p refs  
(AD-A164011; DCIEM-85-R-49) Avail: NTIS HC A03/MF A01  
CSCL 06S

In response to an Unsatisfactory Condition Report, complaints of back pain and discomfort induced by the pilots' seat of the CH113 Labrador helicopter were investigated. Several published reports dealing with the problem are reviewed and summarized in terms of incidence and prevalence rates, frequency, intensity, duration, location and time to pain onset. A questionnaire was developed and distributed to CH113 Labrador helicopter pilots in order to determine how closely the backache characteristics of the pilots match the characteristics reported by the general population. In addition, an evaluation of the size and shape of the Labrador seat was conducted and results were compared to published seat design guidelines and recommendations. Questionnaire results indicate that the typical backache reported by Labrador pilots is similar to the backache reported by other helicopter pilots. It is usually a dull pain in the lumbar area, most often experienced during flight and usually lasting after the mission ends. Subjective results also indicate that backache may be negatively correlated with regular exercise. Based on the symptoms identified in the questionnaire and the causes identified by other investigators, design principles for an improved seat incorporating an inflatable lumbar support and a more effective load bearing seat cushion were established. GRA

**N86-25114#** Toronto Univ., Downsview (Ontario). Defence and Civil Inst. of Environmental Medicine.

**REVIEW OF MODIFIED HEMOGLOBIN SOLUTIONS FOR USE AS TEMPORARY BLOOD SUBSTITUTES**

L. J. J. HRONOWSKI Dec. 1985 31 p refs  
(AD-A164210; DCIEM-85-R-51) Avail: NTIS HC A03/MF A01  
CSCL 06O

The present review will focus on blood substitutes using hemoglobin solutions as oxygen carriers. It will review the more recent developments and discuss the limitations and problems associated with the present hemoglobin preparations. This will be covered under the headings of purification of hemoglobin, modification and polymerization of the hemoglobin molecule and the biological activities of the hemoglobin solutions. Polymerization of hemoglobin is currently the only means of obtaining a physiological concentration of hemoglobin which is iso-oncotic with plasma. Polymerized pyridoxylated hemoglobin is currently the most widely used example of such an iso-oncotic hemoglobin solution having normal oxygen carrying capacity. Such solutions, however, are heterogeneous polydispersed mixtures of widely different molecular weight. In addition, these solutions still contain about 20% of the unpolymerized tetramer which is rapidly eliminated in the urine. These solutions also have oxygen affinities which are considerably higher than those found in the red blood cells. In addition to their effectiveness, the hemoglobin solutions must be shown to be safe. Safety studies on the polymerized and modified hemoglobin solutions must address issues such as hematological responses, vasoactive effects, effect on the reticuloendothelial

system, effect on immunocompetence, antigenicity, nephrotoxicity, and iron toxicity. GRA

**N86-25115#** California Univ., Irvine.

**MULTIDISCIPLINARY STUDIES ON EXCITATORY AMINO ACIDS AS TRANSMITTERS IN THE BRAIN** Final Report, 27 Sep. 1982 - 26 Sep. 1985

C. W. COTMAN 7 Nov. 1985 9 p refs

(Contract DAAG29-82-K-0194)

(AD-A164258; ARO-19016.14-LS) Avail: NTIS HC A02/MF A01  
CSCL 06A

The major goal has been to analyze the excitatory amino acid receptors in the brain, particularly those mediating responses by glutamate and aspartate. Acidic amino acids, principally L-glutamate and L-aspartate, appear to be the major excitatory transmitters in the CNS. As such, these molecules may be the most abundant CNS neurotransmitter class. L-Glutamate shows many of the characteristics of other neurotransmitters. Glutamate is present in high levels in the brain and is relatively enriched in select neurons. Transmitter glutamate is supplied to nerve terminals by synthesis, primarily via the enzyme glutaminase, and by high affinity uptake. The mechanism for transmitter inactivation in the synapse appears to be the rapid removal by a high affinity uptake system. Both endogenous L-glutamate and L-glutamate derived from exogenously supplied radiolabelled precursors exhibit Ca(++)-dependent release upon depolarization. A transport system responsible for the loading of L-glutamate into synaptic vesicles has also been identified. Excitatory amino acids act on a variety of distinct receptor types, and there are now available many compounds which can mimic or block synaptic activity at excitatory amino acid using synapses. Our approach has involved the analysis of these receptors in isolated synaptic membranes and their further definition and anatomical localization via light microscopic autoradiography. GRA

**N86-25116#** Indiana Univ., Bloomington. Dept. of Chemistry.

**ISOTOPIC STUDY OF THE INHALATION TOXICOLOGY OF OXIDANTS**

J. M. HAYES and J. SANTROCK Jun. 1985 200 p Sponsored in part by Health Effects Research Lab.

(PB86-109485; EPA-600/1-85-013) Avail: NTIS HC A09/MF A01  
CSCL 06T

The purpose was to develop novel methods to investigate the biological fate of inhaled ozone and other oxygen-containing pollutants in animal and human tissues using the heavy isotope of oxygen, oxygen-18 (18O). Methods were developed which facilitated the conversion of tissue oxygen to CO2 and the subsequent trapping of the CO2 so that it could be subjected to isotope-ratio mass spectrometry. The ratios of the various masses of evolved CO2 were used to calculate the 18O content of the original tissues, thus enabling the detection of isotopic enrichments as small as 0.4%. The above procedures were performed by modification of a commercially available elemental analyzer to include effluent columns and trapping devices, development of oxygen isotopic standards, and derivation of mathematical models for correction of blank and memory effects originating during sample pyrolysis. These techniques were applied with success to the determination of the biological fate of inhaled ozone, and to the measurement of tissue oxidation induced by a model peroxidation initiator, carbon tetrachloride. Author

**N86-25117#** Federal Communications Commission, Washington, D. C. Office of Science and Technology.

**EVALUATING COMPLIANCE WITH FCC (FEDERAL COMMUNICATIONS COMMISSION) SPECIFIED GUIDELINES FOR HUMAN EXPOSURE TO RADIOFREQUENCY RADIATION**

R. F. CLEVELAND Oct. 1985 58 p  
(PB86-127081; OST/BULL-65) Avail: NTIS HC A04/MF A01  
CSCL 06R

The technical bulletin provides information and guidelines for use in evaluating compliance with FCC-specified environmental rules dealing with human exposure to radiofrequency (RF) radiation. It provides assistance in determining whether an FCC-regulated

facility might create a significant environmental effect due to human exposure to levels of RF radiation in excess of specified radiation protection guides. Emphasis is placed on exposure from broadcast facilities. However, the bulletin also contains information relevant to certain other RF-emitting sources. GRA

**N86-25978\*#** Good Samaritan Hospital and Medical Center, Portland, Oreg. Dept. of Neuro-otology.

**NORMAL AND ABNORMAL HUMAN VESTIBULAR OCULAR FUNCTION Final Technical Report**

R. J. PETERKA and F. O. BLACK May 1986 66 p refs (Contract NCC9-8)

(NASA-CR-176820; NAS 1.26:176820) Avail: NTIS HC A04/MF A01 CSCL 06P

The major motivation of this research is to understand the role the vestibular system plays in sensorimotor interactions which result in spatial disorientation and motion sickness. A second goal was to explore the range of abnormality as it is reflected in quantitative measures of vestibular reflex responses. The results of a study of vestibular reflex measurements in normal subjects and preliminary results in abnormal subjects are presented in this report. Statistical methods were used to define the range of normal responses, and determine age related changes in function.

Author

**N86-25979#** Army Research Inst. of Environmental Medicine, Natick, Mass.

**AEROBIC CAPACITY AND CORONARY RISK FACTORS IN A MIDDLE-AGED ARMY POPULATION AD-A163998 HC A02/MF A01**

J. F. PATTON, J. A. VOGEL, J. L. BEDNEK, JR., D. ALEXANDER, and R. ALBRIGHT Jan. 1986 23 p refs (Contract USRIEM-M-10/86)

(AD-A163998) Avail: NTIS HC A02/MF A01 CSCL 06N

The purpose of this study was to assess the relationship between coronary risk factors (CRF) and aerobic capacity measured by the direct determination of oxygen uptake during maximal exercise testing. Subjects comprised 295 male Army personnel (40 to 53 years of age) who underwent multiple serial screening procedures to include a medical and physical evaluation, calculation of a Framingham risk factor index (RI) and a graded treadmill exercise test (GXT) with the determination of peak oxygen uptake (pVO sub 2). CRF included resting systolic (SBP) and diastolic (DBP) blood pressures, total cholesterol (TC), HDL-C, triglycerides (TRIG), fasting blood sugar (FBS), smoking history, resting ECG, and percent body fat (% BF). The results, although cross sectional, imply that a high level of aerobic capacity is associated with lower coronary risk factors. GRA

**N86-25980#** Army Research Inst. of Environmental Medicine, Natick, Mass.

**FITNESS AND ACTIVITY ASSESSMENTS AMONG US ARMY POPULATIONS: IMPLICATIONS FOR NCHS GENERAL POPULATION SURVEYS**

J. A. VOGEL Jan. 1986 66 p refs

(AD-A164060; USARIEM-M-11/86) Avail: NTIS HC A04/MF A01 CSCL 06N

The military forces of this country represent the largest population for which physical fitness is routinely assessed. Field measures of aerobic power, muscle strength and muscular endurance, along with body weight, are measured twice yearly in the U.S. Army through age 60. Field measures are defined as those conducted by army units without the aid of equipment or indoor facilities. The purpose of these periodic fitness evaluations is both as an indicator of the adequacy of training to meet performance goals as well as a motivator to the individual to train and improve their fitness level. In addition to these periodic field measures, extensive population surveys of laboratory-measured fitness and activity assessment have been made in a wide variety of Army units over the past ten years by the Exercise Physiology Division, US Army Research Institute of Environmental Medicine. These assessments have been part of an ongoing research program to study factors influencing fitness in the Army. This

chapter presents a description of the survey methods and sample data from both approaches. GRA

**N86-25981#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**AN ANALYSIS OF POTENTIAL PREDICTIVE PARAMETERS OF MOTION SICKNESS USING A COMPUTERIZED BIOPHYSICAL DATA ACQUISITION SYSTEM M.S. Thesis**

N. R. JARVIS and C. T. UYEDA, JR. Dec. 1985 254 p refs (AD-A164099; AFIT/GSO/ENG/85D-1) Avail: NTIS HC

A12/MF A01 CSCL 06E

A computerized biophysical data acquisition system was refined and used to collect biophysical data on human volunteer subjects to examine effects of coriolis induced motion sickness. Redesigned sensors to measure electrical cardiac activity, cardiac chest rebound, abdominal/thoracic respiration, peripheral pulse blood volume, facial pulse blood volume, skin temperature, gastric/intestinal activity, nystagmus, and brain wave activity were incorporated with commercially available sensors for galvanic skin response, heart rate, and blood pressure to thoroughly measure the subject's vital signs. Subjects were rotated in a multi-axis motion chair and data collected for later analysis. Data were collected on paper strip chart recorders in parallel with a MASSCOMP MC500 minicomputer. The MASSCOMP data acquisition system software was refined with better documentation to allow data replay. GRA

**N86-25982#** Kentucky Univ., Lexington. Research Lab. **ULTRASONIC QUANTIFICATION OF BLOOD VOLUME REDISTRIBUTION UNDER HYPERGRAVITY Final Report, Feb. 1981 - Sep. 1985**

P. K. BHAGAT and D. R. BROWN 15 Jan. 1986 87 p refs (Contract N00014-85-K-0325)

(AD-A164379) Avail: NTIS HC A05/MF A01 CSCL 06S

In the operation of high performance aircraft, operational crews are often subject to high sustained + or - GZ acceleration. The response of the human cardiovascular system to these acceleration forces has been the object of considerable research. Numerous techniques have been used to measure important parameters of cardiovascular function; however, plethysmographic measurements of blood volume shifts have not been possible during exposure to hypergravity because of unavoidable tissue deformation. Such measurements have added significantly to understanding of the cardiovascular response to postural shifts and to zero-g. A multi-channel instrument has been developed which employs multiple ultrasonic depth measurements to determine the volume of blood contained in the various compartments of the circulation during exposure to hypergravity on a centrifuge. These volume measurements can be used to study the time course and quantity of blood shifts produced by exposure to selected acceleration profiles and physiological manipulations, including anti-G suit inflation. The data obtained should provide improved understanding of basic cardiovascular physiology and of the relative effectiveness of various anti-G devices. GRA

**N86-25983#** California Univ., Irvine. Dept. of Community and Environmental Medicine.

**COMPARATIVE BIOCHEMISTRY AND METABOLISM. PART 2: NAPHTHALENE LUNG TOXICITY Annual Report, Jun. - Dec. 1984**

P. R. RICHIERI and A. R. BUCKPITT Nov. 1985 38 p

(Contract F33615-80-C-0512)

(AD-A163144; AAMRL-TR-85-069) Avail: NTIS HC A03/MF A01 CSCL 06T

The studies reported in this document were to quantitatively examine the diffusion of naphthalene oxide and reactive metabolites from naphthalene in suspensions of isolated mouse hepatocytes and to determine whether the efflux of these metabolites was dependent upon the depletion of intracellular glutathione. The efflux of naphthalene oxide from intact hepatocytes was monitored in incubations containing 3H-glutathione (this tripeptide will not cross the intact hepatocellular membrane) and was based on the measurement of 3H-labelled glutathione adducts. Between 17 and

35% of the total naphthalene oxide formed during the metabolism of naphthalene in the cell was trapped on the exterior of the cell with 3H-glutathione. The fraction of epoxide exiting the hepatocytes as a percentage of the total amount formed did not vary with increasing naphthalene concentrations between 0.005 and 1.5 mM. These data in conjunction with the studies showing that incubation of hepatocytes with naphthalene at concentrations of 0.05 mM or greater caused a significant depletion of intracellular glutathione, suggested that the quantity of naphthalene oxide diffusing as a percentage of the total formed was not dependent upon the intracellular glutathione status. In contrast, the ratio of extracellular vs intracellular covalent binding was dependent on the concentration of naphthalene in the incubation. GRA

**N86-25984#** California Univ., Irvine, Dayton, Ohio.  
**ACUTE TOXICITY STUDIES ON 2 AIR FORCE HYDRAULIC FLUIDS (MLO 82-233 AND MLO 82-585) Technical Report, Apr. 1983 - Mar. 1984**

E. R. KINKEAD, J. R. HOTRON, C. L. GAWORSKI, and R. A. SALOMON Nov. 1985 22 p  
 (Contract F33615-80-C-0512)  
 (AD-A163174; AAMRL-TR-85-070) Avail: NTIS HC A02/MF A01 CSCL 06T

This report describes results of investigations into the acute toxic properties of two operational Air Force hydraulic fluids, MLO 82-233 and MLO 82-585. Various routes of administration were investigated including inhalation, dermal, and oral in rats, guinea pigs, rabbits, and chickens. No acute toxicity occurred in rats with either hydraulic fluid as a results of oral or inhalation exposure at the maximum concentration tested. Dermal exposure of rabbits resulted in no mortalities with either hydraulic fluid. One hydraulic fluid, MLO 82-585, was found to be a moderate skin irritant but neither fluid caused ocular irritation nor did they produce a sensitization response in guinea pigs. Neither fluid would be considered to be a delayed neurotoxin. Author (GRA)

**N86-25985#** California Univ., Irvine, Dayton, Ohio.  
**THE EXPERIMENTAL DETERMINATION OF SAFE ATMOSPHERIC EXPOSURE CONCENTRATIONS OF JP-10 JET FUEL Final Technical Report, Jun. 1978 - Jun. 1984**

C. C. HAUN, E. R. KINKEAD, E. H. VERNOT, J. D. MACEWEN, and R. H. BRUNER Nov. 1985 25 p  
 (Contract F33615-76-C-5005; F33615-80-C-0512)  
 (AD-A163179; AAMRL-TR-85-072) Avail: NTIS HC A02/MF A01 CSCL 06T

Four animal species were exposed for 1 year to 100 ppm (556 cu mg/m) JP-10 to determine its long-term toxic and oncogenic effects. Rats, mice, and hamsters were maintained for 1 year postexposure, while dogs were held for 5 years postexposure. Mean body weights of exposed hamsters and male rats were lower than controls during exposure. Weight recovery occurred in hamsters, but not in male rats during postexposure phase of the study. Significant JP-10 exposure related effects were renal tubular nephrosis together with an increase in benign and malignant renal cell tumors in male rats. Author (GRA)

**N86-25986#** Los Alamos National Lab., N. Mex.  
**TOXICOLOGICAL STUDY OF NTO**

J. E. LONDON and D. M. SMITH Sep. 1985 8 p refs  
 (Contract W-7405-ENG-36)  
 (DE86-003296; LA-10533=MS) Avail: NTIS HC A02/MF A01

The acute oral LD50 values for NTO for mice and rats are greater than 5 g/kg. According to classical guidelines, the test material would be considered only slightly toxic or practically nontoxic in both species. Skin application studies with NTO in rabbits demonstrated that it was mildly irritating cutaneously. With the scoring scheme, the rabbit eye test was considered negative; however, transient conjunctival and corneal irritation did result from the NTO application in several animals and one developed a chronic anterior uveitis. The material did not induce sensitization in the intradermal guinea pig assay. DOE

**N86-25987#** National Center for Health Services Research and Health Care Technology Assessment, Rockville, Md.

**CARDIOKYMOGRAPHY**

E. FEIGENBAUM 1985 9 p refs  
 (PB86-133790; NCHSR-85-127; REPT-10) Avail: NTIS HC A02/MF A01 CSCL 06L

Cardiokymography (CKG) is a non-invasive test to detect stress induced motion abnormalities of the anterior left ventricular wall of the heart for coronary artery disease (CAD). CKG involves translation of heart wall motion into a variable electrical signal that is recorded in graphic form. It may be affected by chest wall motion, systolic rotation of the ventricle, or patient movement. The tracing is a summation of cardio-thoracic movement in the area under the transducer. The utility of CKG in detecting CAD remains equivocal. Reassessment of CKG has disclosed that adequate scientific data are lacking with respect to the diagnostic effectiveness of this technology. At the present time cardiokymography continues to be considered investigational, when used as a method of diagnosing ischemic heart disease. GRA

**N86-25988#** National Academy of Sciences - National Research Council, Houston, Tex.

**EMERGENT TECHNIQUES FOR ASSESSMENT OF VISUAL PERFORMANCE Final Report**

Jun. 1985 77 p refs  
 (Contract N00014-80-C-0159)  
 (PB86-144755) Avail: NTIS HC A05/MF A01 CSCL 06P

Psychophysical research has revealed in recent years that traditional measures of visual acuity and visual field only partially characterize the information processes of the human observer. A survey of recent psychophysical research that has the potential for broadening conventional assessment of visual function is provided. Areas of practice to which such psychophysical research techniques might be applied, are identified. GRA

**N86-25989#** Texas Univ. Health Science Center, Houston. School of Public Health.

**HEALTH EFFECTS OF AMBIENT OZONE EXPOSURE IN VIGOROUSLY EXERCISING ADULTS**

B. J. SELWYN, T. H. STOCK, D. E. JENKINS, D. J. KOTCHMAR, and R. S. CHAPMAN Jan. 1986 21 p refs Sponsored by Health Effects Research Lab. Prepared in cooperation with Baylor College of Medicine, Houston, Tex.  
 (Contract EPA-CR-807108)  
 (PB86-156940; EPA-600/D-86-033) Avail: NTIS HC A02/MF A01 CSCL 06E

The purpose of the analysis was to examine the association of changes in ambient ozone concentrations with changes in the pulmonary function (PFT) of healthy adults after exercising vigorously outdoors. During May-October, 1981, 24 community residents (men and women) ran three miles twice a week some time between 4:30 and 6:30 P.M. at a high school track near Houston, Texas. An air monitoring trailer stood beside the track and monitored environmental variables continuously. The continuously measured environmental variables in this analysis (ozone, temperature, and relative humidity) were averaged over 15 minute intervals. Standard forced expiratory maneuvers were performed before and after each run. Exercise exertion was standardized. GRA

## BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**A86-33776****HUMAN FACTORS SOCIETY, ANNUAL MEETING, 29TH, BALTIMORE, MD, SEPTEMBER 29-OCTOBER 3, 1985, PROCEEDINGS, VOLUMES 1 & 2**

R. W. SWEZEY, ED. Meeting supported by Carlow Associates, Inc., Army, U.S. Nuclear Regulatory Commission, et al. Santa Monica, CA, Human Factors Society, 1985. Vol. 1, 655 p.; vol. 2, 550 p. For individual items see A86-33777 to A86-33830.

Papers are presented on vigilance mechanisms; information-processing approaches to the study of human-computer interaction; human factors in telecommunications; assessing the effects of individual differences on mental and physical workload; computers for training, instruction, and information retrieval; display simplification, visual search, and decluttering; and expert/knowledge-based systems. Topics discussed include vision, information scanning, and retrieval; human factors in accident analysis; managing organizational and product design changes; visual displays and VDT usage; industrial ergonomics; industrial safety; the objectives for human performance and research in military command and control; space and teleoperation; and habitability in constrained/constraining environments. Consideration is given to automation; the use of event-related brain potentials in measurement of attention, performance, and workload; maintenance and simulation training; visual performance and color displays; attention and decision making, human factors in space; and future training technologies. I.F.

**A86-33777****AUTOMATIC AND CONTROLLED PROCESSING APPROACH TO INTERPRETING VIGILANCE PERFORMANCE**

A. D. FISK (South Carolina, University, Columbia) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 14-18. refs

The Fisk and Schneider (1981) data on predicting vigilance performance based on automatic and controlled processing are examined. Controlled processing is defined as serial, limited by short-term memory, under direct control of the individual, modifies long-term memory, and requires little practice; automatic processing is the opposite of controlled. The data reveal that vigilance decrement is reduced if the observer is properly trained and uses automatic processing to detect the target stimuli, and controlled processing is the locus of vigilance effect. The reliability of automatic processing is evaluated by studying the effects of various stressors on automatic and controlled processes. It is observed that automatic processing is unaffected by heat, alcohol, and high mental workloads; however, controlled processing is limited. It is noted that performance is controlled by the processing mode not by factors such as task complexity or stage of processing. I.F.

**A86-33778****INFORMATION PROCESSING IN VIGILANCE PERFORMANCE - COMPLEXITY REVISITED**

J. S. WARM, W. N. DEMBER (Cincinnati, University, OH), T. M. LANZETTA (IBM Corp., Armonk, NY), J. C. BOWERS, and R. J. LYSAGHT IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 19-23. refs

Several experiments are described showing that the vigilance decrement can be reversed or retarded by a suitable level of complexity in symbolic functions needed for critical signal detection. This effect is most likely based upon motivational rather than learning factors and is dependent upon the selection of a complex

task that is no more capacity demanding than a simple one.

Author

**A86-33782****THE INTERFERING EFFECTS OF PROCESSING CODE ON VISUAL MEMORY**

B. P. GOETTL (Illinois, University, Champaign) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 66-70. refs  
(Contract N00014-79-C-0658)

The possibility of reducing task interference in complex aviation environments by taking advantage of the verbal-spatial short term memory dichotomy is explored in a dual-task paradigm. Eighteen subjects performed verbal and spatial retention memory tasks concurrently with intervening verbal and spatial cognitive tasks. Both number and processing code of the intervening tasks were manipulated. Support was found for code-specific interference such that concurrently performed tasks of the same code disrupted performance more than concurrent tasks of different codes. In addition spatial memory was found to be more fragile than verbal memory. Implications of the findings to mental workload reduction include task scheduling, presentation format, and assignment.

Author

**A86-33783\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**ASSESSING SUBJECTIVE WORKLOAD ASSESSMENT - A COMPARISON OF SWAT AND THE NASA-BIPOLAR METHODS**

M. A. VIDULICH and P. S. TSANG (NASA, Ames Research Center, Moffett Field, CA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 71-75. refs

The Subjective Workload Assessment Technique (SWAT) and the NASA weighted-bipolar method used for evaluating subjective workload assessment are compared. The application of these methods to the rating of single- and dual-task trials of tracking and spatial transformation is described. The methods used to collect the ratings for the SWAT and bipolar technique are examined. Analysis of the transformation-tracking data reveal that the two assessment techniques produce similar results and both measure the differences in task difficulty. The positive and negative characteristics of each technique are analyzed. I.F.

**A86-33784\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**TO SPEAK OR NOT TO SPEAK - A MULTIPLE RESOURCE PERSPECTIVE**

P. S. TSANG, E. J. HARTZELL (NASA, Ames Research Center, Moffett Field, CA), and R. A. ROTHSCCHILD (San Jose State University, CA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 76-80. refs

The desirability of employing speech response in a dynamic dual task situation was discussed from a multiple resource perspective. A secondary task technique was employed to examine the time-sharing performance of five dual tasks with various degrees of resource overlap according to the structure-specific resource model of Wickens (1980). The primary task was a visual/manual tracking task which required spatial processing. The secondary task was either another tracking task or a spatial transformation task with one of four input (visual or auditory) and output (manual or speech) configurations. The results show that the dual task performance was best when the primary tracking task was paired with the visual/speech transformation task. This finding was explained by an interaction of the stimulus-central processing-response compatibility of the transformation task and the degree of resource competition between the time-shared tasks. Implications on the utility of speech response were discussed.

Author



A86-33788

**AGE-DEPENDENT CHANGES IN INFORMATION PROCESSING ABILITIES BETWEEN 20 AND 60 YEARS**

R. BRAUNE, C. D. WICKENS, D. STRAYER, and A. F. STOKES (Illinois, University, Savoy) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 226-230. refs  
(Contract N00014-83-K-0747)

Information processing performance in single- and dual-task configurations was examined across 60 subjects between the ages of 20 and 60. The objective was to investigate the general slowing trend observed with increasing chronological age more closely. The results supported this general slowing trend which appears to be more pronounced for complex stimulus materials. However, age did not interact with dual-task loading. Examination of the evoked brain potential data under speed and accuracy instructions suggested that most of the slowing was attributed to response processes rather than those of perception and memory. Furthermore, older subjects were more conservative in placing their response criterion and suffered a smaller loss when placed under speed stress. Author

A86-33792\* Search Technology, Inc., Norcross, Ga.

**AN EXPERIMENTAL APPROACH TO VALIDATING A THEORY OF HUMAN ERROR IN COMPLEX SYSTEMS**

N. M. MORRIS and W. B. ROUSE (Search Technology, Inc., Norcross, GA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 333-337. refs  
(Contract NAS2-12048)

The problem of 'human error' is pervasive in engineering systems in which the human is involved. In contrast to the common engineering approach of dealing with error probabilistically, the present research seeks to alleviate problems associated with error by gaining a greater understanding of causes and contributing factors from a human information processing perspective. The general approach involves identifying conditions which are hypothesized to contribute to errors, and experimentally creating the conditions in order to verify the hypotheses. The conceptual framework which serves as the basis for this research is discussed briefly, followed by a description of upcoming research. Finally, the potential relevance of this research to design, training, and aiding issues is discussed. Author

A86-33794\* Old Dominion Univ., Norfolk, Va.

**EYE-SCAN BEHAVIOR IN A FLIGHT SIMULATION TASK AS A FUNCTION OF LEVEL OF TRAINING**

J. R. COMSTOCK, JR., G. D. COATES, and R. H. KIRBY (Old Dominion University, Norfolk, VA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 391-395.  
(Contract NAG1-451)

The present study explored eye-scan behavior as a function of level of subject training. Oculometric (eye-scan) measures were recorded from each of ten subjects during training trials on a CRT-based flight simulation task. The task developed for the study incorporated subtasks representative of specific activities performed by pilots, but which could be performed at asymptotic levels within relatively short periods of training. Changes in eye-scan behavior were examined as initially untrained subjects developed skill in the task. Eye-scan predictors of performance on the task were found. Examination of eye-scan in proximity to selected task events revealed differences in the distribution of looks at the instruments as a function of level of training. Author

A86-33796

**LEARNING AND PERFORMANCE IN AN AIR REFUELING PART-TASK TRAINER - PRELIMINARY DATA ANALYSIS**

J. E. STEWART, II (USAF, Human Resources Laboratory, Williams AFB, AZ) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 408-411. refs

A86-33800

**HELICOPTER CREW EVALUATIONS ON THE EFFECTS OF VIBRATION ON PERFORMANCE**

R. P. BATEMAN and R. P. WHITE, JR. (Systems Research Laboratories, Inc., Dayton, OH) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 550-553. Navy-supported research. refs

The relationship between aircraft vibration levels, fatigue, and performance is analyzed. Twelve experienced helicopter crew members ranked nine helicopters based on vibration levels and their fatigue levels were evaluated; no correlation between vibration characteristics and the onset of fatigue is observed. The effects of vibration on helicopter operations are examined. It is noted that high workloads and boredom cause fatigue and inhibit performance. I.F.

A86-33804\* Technion - Israel Inst. of Tech., Haifa.

**THE PSYCHOPHYSICS OF WORKLOAD - A SECOND LOOK AT THE RELATIONSHIP BETWEEN SUBJECTIVE MEASURES AND PERFORMANCE**

D. GOPHER, N. CHILLAG, and N. ARZI (Technion - Israel Institute of Technology, Haifa) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 640-644.  
(Contract NAGW-494)

Load estimates based upon subjective and performance indices were compared for subjects performing size matching and letter typing tasks under 6 levels of priorities, in single and dual task conditions. Each half of the group used a different task as reference in their subjective judgement. The results are interpreted to indicate that subjective measures are especially sensitive to voluntary allocation of attention and to the load on working memory. Association with performance is expected whenever these two factors are main determinants of performance efficiency, otherwise the two are likely to dissociate. Author

A86-33806

**ASSESSMENT OF TASK PROFICIENCY IN AIR FORCE OJT**

R. E. WARM (Applied Science Associates, Inc., Valencia, PA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 740-744.

An On-the-Job Training (OJT) task proficiency assessment system was developed and tried out in the Air Force OJT environment. The task evaluation form system includes development procedures which when applied to a specific task allow subject matter experts to generate evaluation instruments. The resulting instruments, called task evaluation forms, accurately and completely depict the critical aspects of task performance. The task evaluation forms can be used by OJT supervisors to detect errors in task performance and derive and scores and pass/fail decisions which reflect observed performance. Author

**A86-33807\*** Toronto Univ. (Ontario).

**AN INVESTIGATION OF THE 'VON RESTORFF' PHENOMENON IN POST-TEST WORKLOAD RATINGS**

D. C. THORNTON (Toronto, University, Canada) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 760-764. refs (Contract NAGW-429)

The von Restorff effect in post-task ratings of task difficulty is examined. Nine subjects performed a hovercraft simulation task which combined elements of skill-based tracking and rule- and knowledge-based process control for five days of one hour sessions. The effects of isolated increases in workload on rating of task performance, and on the number of command errors and river band hits are analyzed. It is observed that the position of the workload increase affects the number of bank hits and command errors. The data reveal that factors not directly related to the task performance influence subjective rating, and post-task ratings of workload are biased. I.F.

**A86-33808\*** Illinois Univ., Savoy.

**THE EFFECT OF VARYING TASK DIFFICULTY ON SUBJECTIVE WORKLOAD**

Y.-Y. YEH, C. D. WICKENS (Illinois, University, Savoy), and S. G. HART (NASA, Ames Research Center, Moffett Field, CA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 765-769.

The effect of different difficulty distribution patterns on subjective workload, and the presence of a primacy/recency effect in subjective ratings are examined. Eight subjects performed the perceptual central processing required for response selection and manual target acquisition for response execution. The reaction time, movement time, and the percent of correct pattern matching and arithmetic equations are analyzed. The data reveal that subjective rating is unaffected by different task difficulty and no primacy/recency effects are observed in subjective ratings. It is concluded that subjective workload reflects the experience of an ongoing integration process. I.F.

**A86-33809**

**TRAINING CHARACTERISTICS OF THE CRITERION TASK SET WORKLOAD ASSESSMENT BATTERY**

R. E. SCHLEGEL (Oklahoma, University, Norman) and C. A. SHINGLEDECKER (Ergometrics Technology, Inc., Dayton, OH) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 770-773. refs (Contract F49620-82-C-0035)

An evaluation of the Criterion Task Set was performed to determine the training requirements for the various tasks. Twenty subjects were divided into four groups. One group trained on all nine tasks in the battery. The other three groups trained on different three-task subsets. All subjects trained for two hours per day on five consecutive days. Response time, accuracy and subjective workload measures were obtained for each trial. The required number of trials for stable performance ranged from two to six with a mode of five. Slight improvements were observed on some tasks after eight to ten trials. Performance by the group trained on all nine tasks was equivalent on half of the tasks and worse on the other half. Subjective workload ratings were highly correlated with the actual performance scores. Author

**A86-33816\*** Georgia Inst. of Tech., Atlanta.

**RULE-BASED ANALYSIS OF PILOT DECISIONS**

C. M. LEWIS (Georgia Institute of Technology, Atlanta) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 907-911. refs (Contract NAG2-123)

The application of the rule identification technique to the analysis of human performance data is proposed. The relation between the language and identifiable consistencies is discussed. The

advantages of production system models for the description of complex human behavior are studied. The use of a Monte Carlo significance testing procedure to assure the validity of the rule identification is examined. An example of the rule-based analysis of Palmer's (1983) data is presented. I.F.

**A86-33818**

**ANTICIPATORY ADJUSTMENTS DURING A WARNING INTERVAL - CORTICAL NEGATIVITY AND PERCEPTUAL SENSITIVITY**

T. F. SANQUIST (Ford Aerospace and Communications Corp., Sunnyvale, CA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 958-961. Navy-supported research. refs

Cortical negative afterwaves were recorded while subjects performed a warned signal detection task. Warning intervals of 500, 1200 and 1900 msec, and immediate and delayed responses were employed as experimental conditions. Detection sensitivity was best at the 1200 msec warning interval, which coincided with maximum cortical negativity. The response requirement manipulation had no effect on detection performance or brain wave amplitude. The results are interpreted as indicating an arousal based allocation of processing resources, indexed by cortical negativity. Author

**A86-33819**

**THE USE OF BRAIN EVOKED RESPONSE IN A CRITICAL EVENT DETECTION TASK**

G. F. WILSON, S. L. WARD, and R. L. HANN (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 962-965. refs

Brain evoked potentials (EP) were used to study subject responses to 'critical events' (CEs) which were part of a series of stimuli. Both reaction times (RT) and EPs were influenced by the appearance of the CE. Longer RTs and a large late positive component of the EP were associated with the trials containing the CE stimuli. Intermediate RTs and late positive components of the EPs were found in a condition in which the stimulus preceding the CE gave information about the following CE and was also similar in appearance. While this is a laboratory test, it is similar in many ways to actual situations confronted by human factors specialists. EPs appear, then, to be useful tools in the system design and evaluation process. Author

**A86-33820**

**EVENT-RELATED BRAIN POTENTIALS AND RESOURCE ALLOCATION - FROM DUAL-TASK DECREMENTS TO DUAL-TASK INTEGRALITY**

A. F. KRAMER and C. D. WICKENS (Illinois, University, Champaign) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 966-970. refs

The use of event-related brain potentials (ERP) in the study of mental workload and resource allocation is discussed. A series of studies are reviewed which, taken together, suggest that the P300 component of the ERP provides a reliable measure of the perceptual/central processing demands of a task. Furthermore, the use of P300 in the assessment of mental workload offers the advantage of not requiring an overt response, thereby eliminating the possibility of secondary task intrusion into primary task performance. The concept of dual-task integrality is introduced and the resource demands of integral task pairs are inferred from measures of P300 amplitude. The finding are discussed in terms of resource models of mental workload. Author



A86-33821

**EVENT-RELATED BRAIN POTENTIALS AND INTERMODAL DIVIDED ATTENTION**

R. PARASURAMAN (Catholic University of America, Washington, DC) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 971-975. refs

Recorded event-related brain potentials (ERPs) are analyzed in order to study attention allocation to visual and auditory channels under high-information load. Ten subjects between 19-25 years monitored an audiovisual display of intermittent 2-degree circles presented centrally and 1000-Hz tones presented binaurally. The relationship between efficiency of target detection in the visual and auditory channel is examined with the performance operating characteristic analysis; a tradeoff in processing between the two channels is detected. The data reveal that intermodality divided attention affects both modality-specific and modality-nonspecific ERP components in practiced subjects under high-information load conditions. The application of the data to models of processing resources and the evaluation of mental workload is described.

I.F.

A86-33822\* Maryland Univ., Baltimore.

**PROCESSING INFERENCES DERIVED FROM EVENT-RELATED POTENTIAL MEASURES IN A MONITORING TASK**

R. L. HORST, R. C. MUNSON (ARD Corp., Columbia, MD), and D. S. RUCHKIN (Maryland, University, Baltimore) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 976-980. refs  
(Contract NAS1-17576)

Event-related potentials (ERPs) were recorded from the scalp of subjects as they monitored changing digital readouts for values that went 'out-of-bounds'. Workload was manipulated by varying the number of readouts that were monitored concurrently. The ERPs elicited by changes in the readouts showed long latency positivities that increased in amplitude, not only with the number of readouts monitored, but also with the number of monitored readouts that were 'in danger' of going out-of-bounds. No effects were found due to the number of nonmonitored readouts 'in danger'. This evidence indicates that subjects (1) selectively attended to the monitored readouts and (2) processed the monitored readouts differently as the readouts approached the out-of-bounds levels to which an overt response was required.

Author

A86-33825\* Illinois Univ., Savoy.

**A COMPARISON OF OPERATOR PERFORMANCE IN MANUAL AND AUTOMATED VERSIONS OF A DYNAMIC DECISION-MAKING TASK**

C. D. WICKENS, Y.-Y. YEH, R. B. FULD, and S. HODEL (Illinois, University, Savoy) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 1089-1091. refs  
(Contract NAG2-308)

The study of operator performance in manual and automated versions of dynamic decision tasks is proposed. The two microcomputer paradigms of simple and complex, dynamic scheduling tasks are described. Error detection accuracy and latency of assignment, and fault detection and correction for the two tasks are to be analyzed.

I.F.

A86-33826

**VOICE AND MANUAL CONTROL IN DUAL TASK SITUATIONS**

C. D. WICKENS (Illinois, University, Savoy), J. ZENYUH (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH), V. CULP (USAF, Mather AFB, CA), and W. MARSHAK (U.S. Air Force Academy, Colorado Springs, CO) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 1093-1097. refs

This paper describes various influences of compatibility and task-resource competition that affect time-sharing a verbal and a manual control task, with either manual or voice control. In the reported experiment subjects performed a two-dimensional discrete tracking task concurrently with a Sternberg memory search task. Each task was controlled either by voice, the left hand, or the right hand. The major influence on performance was the advantage for conditions in which the Sternberg task was voice-controlled and tracking was manually controlled. Voice-controlled tracking produced incompatibility, while bimanual control produced resource competition. Smaller, but still reliable effects were observed for hemispherically-compatible assignments (left-handed tracking).

Author

A86-33827

**EYE AND HEAD RESPONSE TO AN ATTENTION CUE IN A DUAL TASK PARADIGM**

G. L. CALHOUN (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH), C. J. ARBAK (Systems Research Laboratories, Inc., Dayton, OH), and W. P. JANSON (Synergy, Inc., Dayton, OH) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 1125-1129. refs  
(Contract F33615-82-C-0511)

Eight subjects were used to characterize eye and head movements in response to a cue to refixate. The subjects' tasks were to complete a centrally located task and identify vertically peripheral targets. Eye and head reaction time as well as conventional performance measures were recorded. The results showed that the eye and head movement pattern obtained with vertically displaced targets was not identical with those previously obtained with horizontally displaced targets. The results also indicated that eye reaction time, with hard tracking, increases the farther a target is vertically displaced from the centrally located task and head reaction time decreases with the presence of a verbal cue prior to target presentation. Manual reaction time did not, however, decrease with a cue. These results suggest that such unobtrusive measures may be valuable in the design of attention cueing systems.

Author

A86-33830

**FUTURE DIRECTIONS FOR COST EFFECTIVE AIR FORCE AIRCREW TRAINING - MANAGED TECHNOLOGY AND THE TRAINING SYSTEM**

R. J. HEINTZMAN and A. J. COURTICE (USAF, Aeronautical Systems Div., Wright-Patterson AFB, OH) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 1146-1150.

The use of simulation in Air Force flight training is studied. The need for modular simulation hardware, simulator data bases, view display devices, texture systems, and airborne simulation, in order to improve military flight simulation, is discussed. The development of a data base which will provide cost effective management of training programs is examined.

I.F.

A86-33983#

**A HIERARCHICAL MODEL OF PILOT'S PROCEDURAL BEHAVIOR FOR COCKPIT WORKLOAD ANALYSIS**

K. TANAKA and K. MATSUMOTO (National Aerospace Laboratory, Chofu, Japan) (Japan Society for Aeronautical and Space Sciences, Aircraft Symposium, 22nd, Tokyo, Japan, Nov. 27-29, 1984) Japan Society for Aeronautical and Space Sciences, Transactions (ISSN 0549-3811), vol. 28, Feb. 1986, p. 230-239. refs

A dynamic model of human pilot behavior during aircraft operation is presented for the purpose of estimating pilot workload in an automated cockpit environment. On the basis of Rasmussen's hierarchical structure of human behavior (1983), the model is composed of three levels: knowledge-based behavior, rule-based behavior, and skill-based behavior. The model is constructed by taking advantages of LISP, and has the following specific features: goal-oriented and scenario-driven hierarchical structure; sequencer-type procedural behavior; and a group of functions of skill-based behavior. Simulation results of an aircraft operation driven by a sample scenario demonstrate that the model can reproduce estimations of crew's business corresponding to their subjective business, and show the possibility that the model should provide us with a tool for dynamic analysis of pilot behavior.

Author

A86-35286#

**TRAINING OF COSMONAUTS AND EXPERIENCE DURING SPACE FLIGHT**

R. SHARMA (Indian Air Force, New Delhi, India) Aviation Medicine, vol. 29, June 1985, p. 13-17.

This paper presents the experiences of the Indian cosmonaut from the selection stage to the extensive training programs and his observations during the launch, space orbit and successful return to earth. Special reference is made to the effectiveness of yogic exercise in cosmonaut training.

Author

A86-35289#

**SOME ASPECTS OF YOGIC EXERCISES DURING SPACE FLIGHT**

J. M. WADHAWAN (Air Force Hospital, Jorhat, India), M. B. DIKSHIT (Indian Air Force, Institute of Aviation Medicine, Bangalore, India), and P. C. CHATTERJEE (Indian Air Force, New Delhi, India) Aviation Medicine, vol. 29, June 1985, p. 31-37.

The paper discusses some aspects of yogic exercises conducted during the joint Indo-Soviet manned space program. The ground and inflight yogic exercises conducted during the experiment have been discussed with some of their psycho-physiological principles and basis for the selection of these exercises. The experiment was aimed to determine the role of yogic exercises in minimizing the adverse effects of weightlessness during the space flight from April 3, 1984 to April 11, 1984. Preliminary results suggest that yogic exercises had definite beneficial effects on the Indian cosmonaut who was the subject of this study. The positive effects on the motor system were shown by appreciable recovery of EMG potentials following inflight yogic exercises which was found declining initially due to reflex muscular hypotonia. The Indian cosmonaut also maintained a state of psycho-physiological well being during the space flight.

Author

A86-35427\* Essex Corp., Orlando, Fla.

**AUTOMATED PORTABLE TEST SYSTEM (APTS) - A PERFORMANCE ENVELOPE ASSESSMENT TOOL**

R. S. KENNEDY (Essex Corp., Orlando, FL), W. P. DUNLAP (Tulane University, New Orleans, LA), M. B. JONES (Pennsylvania State University, Hershey), R. L. WILKES (Casper College, NY), and A. C. BITTNER, JR. (U.S. Navy, Naval Biodynamics Laboratory, New Orleans, LA) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 3-13. refs

(Contract NSF BSN-84-60765; NAS9-16982)

(SAE PAPER 851775)

The reliability and stability of microcomputer-based psychological tests are evaluated. The hardware, test programs, and system control of the Automated Portable Test System, which assesses human performance and subjective status, are described. Subjects were administered 11 pen-and-pencil and microcomputer-based tests for 10 sessions. The data reveal that nine of the 10 tests stabilized by the third administration; inertial correlations were high and consistent. It is noted that the microcomputer-based tests display good psychometric properties in terms of differential stability and reliability.

I.F.

A86-35428

**ASSESSING THE HUMAN PERFORMANCE ENVELOPE - A BRIEF GUIDE**

A. C. BITTNER, JR., M. M. HARBESON (U.S. Navy, Naval Biodynamics Laboratory, New Orleans, LA), R. S. KENNEDY (Essex Corp., Orlando, FL), and N. C. LUNDY (Lundy and Associates, Bay St. Louis, MS) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 15-25. refs

(SAE PAPER 851776)

The procedures for assessing the human performance envelope are reviewed. The selection of the performance measures which provide the greatest potential utility and are easily interpretable is discussed. The use of the proper assessment methodology in multiple- and single-subject experiments is examined.

I.F.

A86-35429

**MENTAL FITNESS FOR DUTY AND CONTROL OF AROUSAL STATE**

H. NAGANO (Japan Air Lines Co., Ltd., Tokyo) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 27-29.

(SAE PAPER 851778)

Human factors in flight operations are studied. The two aspects essential for flight management, 'think ahead' and 'fly the aircraft', are described. The need for the pilot to control arousal level in order to maintain the reliability of the brain and perform required procedures is examined. The relationship between human factors and automation is analyzed. The development of improved training procedures for airline pilots in Japan is discussed.

I.F.

A86-35430

**INTERACTIVE COMPUTER-BASED FLIGHT TRAINING**

J. M. CHILDS (BDM Corp., McLean, VA) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 33-38.

(SAE PAPER 851991)

This paper describes a recently developed interactive computer-based flight training program. The program is to be used in conjunction with flight simulator training for the U.S. Coast Guard HU-25A (Falcon) aircraft. Reduced costs and enhanced pilot proficiency are expected to accrue relative to the current program.

Author

**A86-35434\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

**ASTRONAUT CREW PERFORMANCE - RECENT SPACE EXPERIENCE**

P. A. SANTY and J. L. LEWIS (NASA, Johnson Space Center, Houston, TX) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings . Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 71-74. refs  
(SAE PAPER 851802)

The performance and productivity of astronauts in space are studied. The effects of the space and spacecraft environments, man/machine interaction, work-rest cycles, and psychological factors on man's performance in space are examined. The objectives of the Gemini, Apollo, and Skylab programs and the performance data collected on these missions are analyzed. I.F.

**A86-35441**

**PILOT SPEECH PERFORMANCE WHILE TALKING TO A SPEECH RECOGNIZER AND FLYING A COMPETITIVE HELICOPTER PURSUIT TASK**

C. A. SIMPSON (Psycho-Linguistic Research Associates, Menlo Park, CA) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings . Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 133-141. Army-supported research. refs  
(SAE PAPER 851779)

The performance of pilots and connected-word speaker dependent speech recognizers under task loading conditions are evaluated. Ten male pilots performed recognizer template enrollment, pilot message categorization training, and warning message classification and gunner/scout pursuit tasks; the experimental conditions and procedures are described. Pilot response accuracy, pilot-machine system response accuracy, recognizer-computer performance, and recognition algorithm performance are examined. Individual performance differences among pilots and the effects of task loading on recognition accuracy are analyzed. The isolated-word recognition algorithm data of Simpson (1985) and the connected-word recognition algorithm data are compared. The data reveal that the isolated-word algorithm is inadequate for aircraft cockpit use; however, the connected-word algorithm is applicable for noncritical flight functions. I.F.

**A86-35445**

**A CASE FOR REALISTIC TRAINING**

J. S. CLAUZEL (Douglas Aircraft Co., Long Beach, CA) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings . Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 175, 176.  
(SAE PAPER 851915)

The development of a realistic program for training flight crews is discussed. The use of instructional techniques, equipment, and simulation in crew training is examined. It is noted that the application of the training information to emergency situations could reduce the number of aircraft accidents. I.F.

**A86-35446\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**REALISTIC TRAINING FOR EFFECTIVE CREW PERFORMANCE**

H. C. FOUSHEE (NASA, Ames Research Center, Moffett Field, CA) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings . Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 177-181.  
(SAE PAPER 851916)

Evaluation of incident and accident statistics reveals that most problems occur not because of a lack of proficiency in pilot training, but because of the inability to coordinate skills into effective courses of action. Line-Oriented Flight Training (LOFT) and Cockpit Resource Management (CRM) programs provide training which will develop both individual crew member skills, as well as those associated with effective group function. A study conducted by

NASA at the request of the U.S. Congress supports the argument for training that enhances crew performance in addition to providing individual technical skills, and is described in detail. Author

**A86-35447**

**THE CASE FOR TRAINING FOR THE POTENTIALLY CATASTROPHIC SITUATION**

G. S. MILLS (McDonnell Aircraft Co., St. Louis, MO) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings . Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 183-187.  
(SAE PAPER 851917)

The need to train pilots to handle unusual emergency situations is examined. The use of simulators to train pilots for potentially catastrophic situations is discussed. Examples of situations in which pilots require further training, such as blown tires on take off and landing, wet/icy runways in strong crosswinds, aircraft stalls and spins, maximum lift performance of aircraft, and yawing moment characteristics, are presented. I.F.

**A86-35667\*** Systems Technology, Inc., Mountain View, Calif.

**ASSESSMENT OF SIMULATION FIDELITY USING MEASUREMENTS OF PILOTING TECHNIQUE IN FLIGHT. II**

S. W. FERGUSON, W. F. CLEMENT (Systems Technology, Inc., Mountain View, CA), R. H. HOH (Systems Technology, Inc., Hawthorne, CA), and W. B. CLEVELAND (NASA, Ames Research Center, Moffett Field, CA) AHS, Annual Forum and Technology Display, 41st, Fort Worth, TX, May 15-17, 1985, Paper. 24 p. Army-sponsored research. refs  
(Contract NAS2-11098; NAS2-11731)

Two components of the Vertical Motion Simulator (presently being used to assess the fidelity of UH-60A simulation) are evaluated: (1) the dash/quickstop Nap-of-the-earth (NOE) piloting task, and (2) the bop-up task. Data from these two flight test experiments are presented which provide information on the effect of reduced visual field of view, variation in scene content and texture, and the affect of pure time delay in the closed-loop pilot response. In comparison with task performance results obtained in flight tests, the results from the simulation indicate that the pilot's NOE task performance in the simulator is significantly degraded. K.K.

**A86-36175**

**AN INTEGRATED DISPLAY FOR VERTICAL AND TRANSLATIONAL FLIGHT EIGHT FACTORS AFFECTING PILOT PERFORMANCE**

J. S. TATRO (Bell Helicopter Textron, Fort Worth, TX) and S. N. ROSCOE (New Mexico State University, Las Cruces) Human Factors (ISSN 0018-7208), vol. 28, Feb. 1986, p. 101-120. refs  
(Contract N00014-81-K-0439)

As part of an overall research program to optimize both forward-looking and downward-looking tactical situation displays for all-weather instrument flight in vertical takeoff and landing (VTOL) aircraft, an integrated horizontal situation display was developed for both vertical and translational flight. This paper covers the developed and initial experimentation of the downward-looking portion of the overall display and control system. The effects of eight factors on pilot performance were tested, and a multiple regression model of VTOL pilot performance as a function of those eight factors was derived for each of three dependent performance measures. Factors having important effects were position error magnification, control order, prediction time, control gain, tracking mode, and several of their interactions. Author

A86-36500

**CONTROLLING OF PILOT WORK CAPACITY BY PSYCHOSOMATIC SELF-REGULATION TECHNIQUES [UPRAVLENIE RABOTOSPOSOBNOST'IU LETCHIKA METODOM PSIKHOSOMATICHESKOI SAMOREGULIATSII]**S. G. MELNIK and A. V. SHAKULA *Voenno-Meditsinskii Zhurnal* (ISSN 0026-9050), Feb. 1986, p. 37-39. In Russian. refs

The effect of psychosomatic self-regulation training on the work capacity and the psychophysiological state of pilots was investigated. The training method consisted of eight 20-min-long recorded group instructions, followed by two weeks of relaxation training sessions. The results of the training efficiency were evaluated by measuring the postflight heart contraction rates and blood pressures and by comparing the in-flight work efficiency and piloting techniques in trained and untrained pilots assigned to long-time flights or to frequently repeated destroyer-flight missions. The pilots trained in self-regulation exhibited smaller increases in rates of heart contractions and in blood pressures and higher levels of work capacity and piloting technique. Moreover, in the second year after the training in self-regulation, the time losses due to illness were lower by a factor of 3 in comparison with the control group. I.S.

A86-36947

**VISUAL CUE DOMINANCE HIERARCHIES - IMPLICATIONS FOR SIMULATOR DESIGN**

R. WARREN (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) and G. E. RICCIO (Systems Research Laboratories, Inc., Dayton, OH) IN: *Flight simulation/simulators; Proceedings of the Aerospace Technology Conference and Exposition*, Long Beach, CA, October 14-17, 1985. Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 61-75. refs (SAE PAPER 851946)

Fidelity requirements of flight simulators are addressed by proposing a classification based on informational, perceptual, experiential, and action implications. Fidelity assessment is argued to begin with cue inventory definition and empirical research. Cue evaluation is complex due to the presence of multiple cues for a single referent. A dominance hierarchy may emerge allowing little incidental learning to weak cues. An altitude holding experiment is reported to illustrate cue dominance effects. Other studies are discussed which also indicate possible non-optimum effects of using scenes with multiply redundant cues. Since certain flight situations may delete dominant cues, pilots need to be experienced using the weaker cues and this implies using simulators in reduced cue modes. Hence, maximum fidelity is not always desirable.

Author

N86-25118# Air Force Academy, Colo.

**BEHAVIORAL CONSIDERATIONS FOR SPACE STATION DESIGN Final Report, Oct. 1984 - Dec. 1985**

F. R. WOOD and K. O. DUNIVIN Jan. 1986 69 p refs (AD-A163478; USAFA-TR-86-3) Avail: NTIS HC A04/MF A01 CSCL 05J

Flight crews are more than just the sum of the members' individual technical skills. They are dynamic and constantly changing systems of interacting units. The critical factor in this system is the interaction process. Factors which affect this interaction process are design considerations critical to the successful operation of the human system in space. Future space missions will be longer and will involve more routine tasks. Crews will be larger and more heterogeneous. These conditions make proper consideration of group dynamics principles imperative. Formal design of future space missions should consider critical design factors which promote the group process. The real change to current NASA mission design suggested by this report is that greater consideration be given to the informal processes characteristic of the human system. Consideration of these factors will pay large dividends in terms of human system performance and neglect of these factors will incur costs. GRA

N86-25119# Colorado Univ., Boulder. Center for Research on Judgment and Policy.

**GENERALIZING OVER CONDITIONS BY COMBINING THE MULTITRAIT MULTIMETHOD MATRIX AND THE REPRESENTATIVE DESIGN OF EXPERIMENTS**

K. R. HAMMOND, R. M. HAMM, and J. GRASSIA Jan. 1986 64 p refs

(Contract N00014-81-C-0591; BRSG-RR-07013-14)

(AD-A163685; CRJP-255A) Avail: NTIS HC A04/MF A01 CSCL 05J

Analytical methods should be substituted for the current largely intuitive methods for generalizing results over conditions. Toward that end we present a methodology that combines Campbell and Fiske's (1959) multitrait multimethod matrix and Brunswik's (1956) representative design of experiments. A description of a study of expert judgement and a critique of current practices illustrate the methodology. GRA

N86-25120# Stanford Univ., Calif.

**STATISTICAL INFERENCES IN CROSS-LAGGED PANEL STUDIES**

L. S. MAYER Nov. 1985 51 p refs

(Contract DAAG29-82-K-0156)

(AD-A163892; TR-15; ARO-19065.16-MA) Avail: NTIS HC A04/MF A01 CSCL 12A

Cross-lagged panel studies are statistical studies in which two or more variables are measured for a large number of subjects at each of several waves or points in time. The variables divide naturally into two sets and the primary purpose of the analysis is to estimate and test the cross-effects between the two sets. Such studies are found in the mainstreams of social behavioral and business research. One approach to this analysis is to express the cross-effects as parameters in regression equations and then use regression methods to estimate and test the parameters. We contribute to this approach by extending the regression model to a multivariate model that captures the correlation between the dependent variables. We develop estimators for the parameters of this model and hypothesis tests for assessing the presence of effects and cross-effects. We demonstrate our results with the analysis of a cross-lagged panel study of the perceptions and attitudes of patients toward a health maintenance organization.

Author (GRA)

N86-25990# Minnesota Univ., Minneapolis. Computerized Adaptive Testing Lab.

**PROCEEDINGS OF THE ITEM RESPONSE THEORY AND COMPUTERIZED ADAPTIVE TESTING CONFERENCE Final Report**

D. J. WEISS Apr. 1985 382 p Conference held at Wayzata, Minn., 27-30 Jun. 1982

(Contract N00014-82-G-0061)

(AD-A163040) Avail: NTIS HC A17/MF A01 CSCL 05J

This report is the Proceedings of the 1982 Item Response Theory and Computerized Adaptive Testing Conference held July 27-30, 1982 at the Spring Hill Conference in Wayzata, Minnesota. These Proceedings include all papers presented at the conference and discussions of these papers by the scheduled discussants. The papers are organized into the following sessions: (1) Development in Latent Trait Theory; (2) Parameter Estimation; (3) Multidimensional Item Response Theory; (4) Estimating Parameters with the E-M Algorithm; (5) Unidimensionality and Robustness; (6) Adaptive and Sequential Testing; (7) Latent Trait Models for Special Applications; and (8) Applications of Computerized Adaptive Testing. GRA

**N86-25991#** Air Force Human Resources Lab., Brooks AFB, Tex.

**THEORY-BASED COGNITIVE ASSESSMENT Interim Paper, Oct. 1984 - Sep. 1985**

P. C. KYLLONEN Jan. 1986 35 p refs  
(AD-A164083; AFHRL-TP-85-30) Avail: NTIS HC A03/MF A01 CSCL 05J

This paper reviews the theoretical foundations, current issues, and a number of recent studies in the area of cognitive ability assessment, with particular focus on personnel selection and classification applications. A brief review of the history of aptitude testing is provided, with particular emphasis on the cognitive psychology, along with the availability of modestly priced microcomputer systems, hold promise for improvements in ability assessment technology. Recent studies conducted at the Air Force Human Resources Laboratory as part of the Learning Abilities Measurement Program and similar projects are reported. The focus of these studies has been on determining (1) the utility of various cognitive tasks for providing meaningful information on individual cognitive skill levels, (2) whether such tasks tap abilities not measured by currently operational paper-and-pencil tests, and (3) how changes in processing efficiency can be analyzed. Cognitive diagnostic as well as selection-and-classification applications are discussed. GRA

**N86-25992#** Engineering Research Associates, Inc., Vienna, Va.

**SCHEMA-BASED THEORY OF INFORMATION PRESENTATION FOR DISTRIBUTED DECISION MAKING Interim Report**

D. F. NOBLE and J. A. TRUELOVE Aug. 1985 120 p refs  
(Contract N00014-84-C-0484)  
(AD-A163150; R-028-85) Avail: NTIS HC A06/MF A01 CSCL 05J

The Schema-Based Theory of Information Presentation for Distributed Decision Making describes a schema structure appropriate for understanding connections between the way that information is presented and its impact on distributed decision making. The theory suggests a process for determining how information should be presented so that consensus and coordination will be improved and decision conflicts will be reduced. The theory proposes that experienced decision makers select alternatives by mental processes that match the features of the current situation to features of reference situations for which possible alternatives are known to be appropriate. These reference situations may specify particular threat activities and dispositions, own Battle Group objectives, prescribed contingency plan action, and decision behavior of other decision makers to the group. Information presented according to the principles derived from the theory will encourage each decision maker to more fully consider the impact of each action on the objectives of other decision makers. Applying the principles requires that the general schema used by decision makers be determined prior to the time when particular situation-specific information is presented. Given this prior determination, the principles suggest what emphasis needs to be given to specific features and feature relationships in the presentation of the current situation. GRA

**MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT**

Includes human engineering; biotechnology; and space suits and protective clothing.

**A86-33779**

**THE USE OF SIGNAL DETECTION THEORY IN RESEARCH ON HUMAN-COMPUTER INTERACTION**

R. PARASURAMAN and G. WISDOM (Catholic University of America, Washington, DC) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 33-37. refs

The use of signal detection theory (SDT) in evaluating attentional and decision-making performance in the context of human-computer interaction is reviewed. SDT provides a means for distinguishing between accuracy and criterion setting in decision-making environments. This is useful in evaluating the effectiveness of the decision-making performance of an intelligent machine, a human user, or a human-machine system. SDT is also useful in deciding how best to allocate subtasks and functions in human-computer monitoring systems. Applications of SDT to the evaluation of rule bases in expert systems and the design of computer assistance in human-computer monitoring are discussed. Author

**A86-33781**

**THERE'S A VOICE IN THE SKY - BUT CAN A PICTURE TELL YOU MORE?**

C. P. ROBINSON (USAF, Aeronautical Systems Div., Wright-Patterson AFB, OH) and R. E. EBERTS (Purdue University, West Lafayette, IN) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 61-65. refs

A current trend in cockpit design is to incorporate synthesized speech to present secondary information. Multiple resource theories of information processing support this, but theories of stimulus-central processing-response compatibility suggest that spatial information presented visually may have some advantages over speech. An experiment was run comparing tracking and response performance when information was presented pictorially and by speech. Pictorial subjects responded quicker and improved more with learning than did speech subjects. More research on the spatial advantages of pictorial displays is needed before too many speech displays are incorporated into the cockpit. Author

**A86-33785**

**ASSESSMENT OF SWAT ACCURACY**

M. E. REVESMAN (BDM Corp., Albuquerque, NM) and S. M. ROKICKI (USAF, Operational Test and Evaluation Center, Kirtland AFB, NM) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 183-187.

Recently, the Subjective Workload Assessment Technique (SWAT) has become a popular tool for assessing mental workload. SWAT attempts to estimate an individual's internal representation of mental workload from a rank ordering of combinations of mental workload factors. This paper presents an experiment in which these internal values were simulated on a computer. Conjoint analysis was performed on rank orders produced from the internal values with and without noise added. Results indicated that conjoint analysis was able to accurately estimate the 'true' rankings and values, even when noise was present. In addition, linear regression was found to be a poor estimator of the 'true' values, while a simpler technique, rank summing, was found to be as accurate an estimator as conjoint analysis. Author

A86-33786

**METHODS AND SYSTEMS FOR MEASURING HUMAN PERFORMANCE CAPABILITIES**

C. A. SHINGLEDECKER, M. S. CRABTREE (Ergometrics Technology, Inc., Dayton, OH), and F. T. EGGEMEIER (Wright State University, Dayton, OH) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 210-214. refs

Theoretical and experimental factors that affect the applicability of standardized human performance assessment techniques are analyzed. The Criterion Task Set in which a theoretical model of human performance is used as the primary factor in the selection of component tasks is described. The reliability and sensitivity of human performance assessment batteries are examined. The advantages the microcomputer provides to the implementation of task batteries are discussed. I.F.

A86-33787

**WORKLOAD MEASUREMENT IN SYSTEM DESIGN AND EVALUATION**

F. T. EGGEMEIER (Wright State University, Dayton, OH), C. A. SHINGLEDECKER, and M. S. CRABTREE (Ergometrics Technology, Inc., Dayton, OH) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 215-219. refs  
(Contract F33615-82-K-0522)

Because of its central role in system development, workload measurement has been extensively researched. These efforts have produced a variety of workload assessment techniques, many of which can be classified as either subjective, physiological, or behavioral measures. These categories of measures can vary along several dimensions that can be used as criteria in selection of a technique for a particular application. The proposed selection criteria include the sensitivity, diagnosticity, and intrusiveness associated with a technique. Different stages of system design can require techniques that differ on the noted dimensions. Since no technique is capable of meeting all of the applicable criteria, a comprehensive approach to workload assessment will require a battery of subjective, physiological, and behavioral measures. Further research dealing with comparative evaluation of the various assessment techniques along the noted dimensions will be required in order to refine workload metric selection criteria. Author

A86-33789

**FEATURE POSITIVE CODING EFFECTS ON OBJECT LOCALIZATION**

D. L. WILSON (Science Applications International Corp., Dayton, OH), R. K. BURNS (USAF, Aeronautical Systems Div., Wright-Patterson AFB, OH), and G. G. KUPERMAN (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 292-296. refs

An investigation of feature positive information coding which included clutter level and display polarity as independent variables was conducted. Three dependent measures were considered: search time, designation time, and designation accuracy. Twelve subjects performed a target location/designation task under 72 combinations of the experimental variables. For search time, the main effects of feature coding and clutter level together with their interaction were found to be significant ( $p$  less than 0.01). For designation time, only the main effect of clutter was significant ( $p$  less than 0.05). No significant findings were identified for designation accuracy. Author

A86-33790\* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**DECLUTTERING METHODS FOR HIGH DENSITY COMPUTER-GENERATED GRAPHIC DISPLAYS**

E. E. SCHULTZ, JR., D. A. NICHOLS, and P. S. CURRAN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 300-303.

Several decluttering methods were compared with respect to the speed and accuracy of user performance which resulted. The presence of a map background was also manipulated. Partial removal of nonessential graphic features through symbol simplification was as effective a decluttering technique as was total removal of nonessential graphic features. The presence of a map background interacted with decluttering conditions when response time was the dependent measure. Results indicate that the effectiveness of decluttering methods depends upon the degree to which each method makes essential graphic information distinctive from nonessential information. Practical implications are discussed. Author

A86-33791

**A PERIPHERAL INTEGRATED STATUS DISPLAY - IS IT REALLY GIVING THE 'BIG PICTURE' OR IS IT A MINISERIES?**

D. B. BERINGER (Wisconsin, University, Madison) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 304-307. refs

Much effort has been directed towards the creation of effective integrated displays for vehicle or system control. These efforts have generally been aimed at 'primary' instruments or indices of system performance and only comparatively recently have secondary indices received similar attention. Each group of indices, however, has generally been kept separate, resulting in systems having multiple nonintegrated integrated displays. A method is proposed whereby these may be combined within a single instrument or 'integrated' integrated display. This method is based upon the use of spatial cues created by regular versus irregular polygons. A major question at issue is whether such a display created by regular versus irregular polygons. A major question at issue is whether such a display constitutes a single integrated shape or merely an assembly of subshapes that are serially scanned. Author

A86-33795

**PRO-SWAT APPLIED TO ADVANCED HELICOPTER CREW STATION CONCEPTS**

G. G. KUPERMAN (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 398-402. refs

The Subjective Workload Assessment Technique was applied projectively (Pro-SWAT) to the prediction of workload to be expected in a single-pilot, advanced scout/attack helicopter weapon system. A composite mission scenario was created. Five configurations of the pilot/vehicle interface were synthesized, each based on some form of a virtual panoramic display (VPD). They were assessed at each of six segments extracted from the mission scenario. An analysis of variance, with predicted workload as the dependent measure, found highly significant differences between both mission segments and VPD concepts ( $p$  less than 0.01). Author

A86-33797

**THE SACCADIC EYE MOVEMENT CONTROL SYSTEM**

J. HENDRICKSON (Old Dominion University, Norfolk, VA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 427-430. refs

This paper reports the results of an effort to construct a computer model of the saccadic eye movement control system.

The purpose of the system, the structure of the system, and measures of system performance were identified. A model of the system was constructed and a computer simulation of the model was developed and exercised. The performance of the computer model was then compared with the measured performance of the system and the validity of the model was determined. Author

**A86-33798****SHADOW MASK DISPLAY VISIBILITY - HUMAN THRESHOLDS FOR PERCEPTION OF MISCONVERGENCE EFFECTS**

O. K. HANSEN (HEDCON, Inc., Villa Park, CA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1985, p. 431-435.

A psychophysical study was conducted to identify the acceptable limits of misregistration of the color vector beams in a 'delta gun' shadow mask display. The criteria for acceptability were the perceptual responses of sixteen male pilots who viewed the display and adjusted the beam convergence to achieve various visual effects. Results are discussed in terms of display image perception and engineering design standards. Author

**A86-33803****A WORKLOAD ANALYSIS FOR STRATEGIC CONVENTIONAL STANDOFF CAPABILITY MISSIONS**

G. G. KUPERMAN (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH) and D. L. WILSON (Science Applications International Corp., Dayton, OH) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 635-639. refs

This paper presents the methodology and supporting rationale for the investigation of operator workload in the context of an enhancement to an existing weapon system. The methodology is applicable early in the conceptual design process and forms the baseline data from which final design validation may be developed. The Subjective Workload Assessment Technique (SWAT), used projectively, forms the kernel of the methodology. A strategy for building part-task through full-mission simulations, at increasing levels of face and content validity, is presented in the context of the weapon system development process. Author

**A86-33805****APPLICABILITY OF USING THE CAR-II MODEL IN DESIGN AND EVALUATION OF MULTIOPERATOR WORKSTATIONS WITH SHARED CONTROLS**

S. J. MORRISSEY, B. E. HERRING (Auburn University, AL), and M. G. GENNETTI (Stanford University, CA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 698-701.

This study was done to show how a computerized workstation design program could be used to design and evaluate workstations having multiple operators with shared or common controls. To do this the Computerized Assessment of Reach program (CAR) was used to evaluate the cockpit of the OH-58A (Huey) helicopter. This same program was then used to demonstrate methods of cockpit redesign. Author

**A86-33810****TIMEBASED ANALYSIS OF SIGNIFICANT COORDINATED OPERATIONS (TASCO) - A COCKPIT WORKLOAD ANALYSIS TECHNIQUE**

M. G. ELLISON and B. B. ROBERTS (Computer Sciences Corp., Edwards AFB, CA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 774-778.

TASCO has been developed to provide a diagnostic tool to aid in avionics operation task structuring. The objective of the TASCO logic is to determine the optimum organization of cockpit activities considering task complexity and task execution time compared to estimated time available to perform the task set.

The TASCO cockpit workload analysis technique measures and evaluates the relationships between pilot proficiency, experience, and weapon system complexity in order to reduce risk in task performance. Author

**A86-33811****TELEOPERATION OF LEGGED VEHICLES - UNIQUE PROBLEMS ASSOCIATED WITH WALKING AND FOOT PLACEMENT**

R. J. GERTH, D. B. BERINGER, and J. C. MUNDT (Wisconsin, University, Madison) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 834-838. refs

Teleoperation of legged walking vehicles poses some interesting problems in display and control design. Informational needs associated with individual foot placement when traversing rough terrain are explained. Problems faced in meeting those needs and vision, display, and control system options are presented. Future research is also described. Author

**A86-33813\*** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**HUMAN PRODUCTIVITY OF SPACE STATION**

K. F. WILLSHIRE (NASA, Langley Research Center, Hampton, VA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 843-845.

The objectives of NASA's Space Station Human Productivity Program are examined: The design and functions of the Space Station are described. The effects of the interior architecture, crew support, crew activities, intravehicular activity (IVA) systems, and extravehicular/IVA interfaces on the productivity of the Space Station are investigated. It is estimated that crew productivity should be sustained for a 90-day tour at levels above 90 percent of the initial mission performance level. I.F.

**A86-33817****AN AUTOMATED METHODOLOGY FOR CONDUCTING HUMAN FACTORS EVALUATIONS OF PROTECTIVE GARMENTS**

H. GREGOIRE (Southern California, University, Los Angeles, CA), D. W. CALL, L. C. OMLIE (U.S. Navy, Naval AirTest Center, Patuxent River, MD), and R. J. SPICUZZA (Systems Research Laboratories, Inc., California, MD) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 916-919. Navy-supported research.

**A86-33823****RESEARCH ON THE SPECIFICATION AND ACQUISITION OF MAINTENANCE TRAINING SIMULATORS IN THE U.S. AIR FORCE**

R. J. CARROLL and J. A. FITZPATRICK (Applied Science Associates, Inc., Valencia, PA) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 1012-1016. refs

**A86-33828\*** Martin Marietta Corp., Denver, Colo.

**CHARACTERIZATION OF GOOD TELEOPERATORS - WHAT APITUDES, INTERESTS, AND EXPERIENCE CORRELATE WITH MEASURES OF TELEOPERATOR PERFORMANCE**

J. P. YORCHAK, C. S. HARTLEY (Martin Marietta Corp., Space Operations Simulator Laboratory, Denver, CO), and E. HINMAN (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1985, p. 1135-1139. refs (Contract NAS8-35184)

The use of aptitude tests and questionnaires to evaluate an individuals aptitude for teleoperation is studied. The Raven Progressive Matrices Test and Differential Aptitude Tests, and a 16-item questionnaire for assessing the subject's interests,



academic background, and previous experience are described. The Proto-Flight Manipulator Arm, cameras, console, hand controller, and task board utilized by the 17 engineers are examined. The correlation between aptitude scores and questionnaire responses, and operator performance is investigated. Multiple regression data reveal that the eight predictor variables are not individually significant for evaluating operator performance; however, the complete test battery is applicable for predicting 49 percent of subject variance on the criterion task. I.F.

**A86-34923#**

#### **HELICOPTER FLIGHT CONTROL WITH ONE HAND**

A. L. LIPPAY, M. KING, R. V. KRUK (CAE Electronics, Ltd., Montreal, Canada), and M. MORGAN (National Aeronautical Establishment, Ottawa, Canada) (CASI, Annual General Meeting, 32nd, Montreal, Canada, May 27, 1985) Canadian Aeronautics and Space Journal (ISSN 0008-2821), vol. 31, Dec. 1985, p. 335-345. refs

In a given control task, human error rate may increase in proportion to the number of control devices and mental transformations. A single device whose degrees of freedom coincide spatially with the principal task parameters, and whose dynamic characteristics provide a modicum of feedback representing the demands imposed on the system, should permit a reduction of the (human) control problem. A deflection-type side-arm controller developed in Montreal is described, which enables axis-by-axis or co-ordinated control in up to six degrees of freedom with one hand. The design minimizes unwanted inputs and cross-coupling between axes. Six-axis control was established in several spacecraft and manipulator simulations. A four-axis version has been installed in a research helicopter. Preliminary testing indicated good pilot acceptance, reduced training/familiarization requirements and - in some cases - significant improvement in control performance. A second generation engineering effort is currently in progress to produce high quality units for formal testing and eventual flight qualification. Author

**A86-34957**

#### **ADVANCED MANIPULATOR SYSTEM ARCHITECTURAL REQUIREMENTS FOR SPACE STATION**

P. KUMAR and S. SACHDEV (Spar Aerospace, Ltd., Remote Manipulator Systems Div., Toronto, Canada) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985. Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 2-1 to 2-8.

Remote manipulator systems must be governed by concepts and requirements related to maintainability and autonomy for indefinite life. It is required that these systems provide operational autonomy resulting in operations independent of ground and machine autonomy resulting in routine tasks being performed by automated and expert system features. Moreover, these systems must be space maintainable. These requirements embody the lower tier requirements of automation, reliability, safety, fault tolerancing and artificial intelligence features. The requirement for manipulator mobility is discussed, and a Space Station era manipulator system is presented with function-allocation to various levels of control hierarchy and constituents of a system data base. K.K.

**A86-34959\*** Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

#### **RECENT ADVANCEMENTS IN TELEPRESENCE TECHNOLOGY DEVELOPMENT**

K. CORKER (Bolt Beranek and Newman, Inc., Cambridge, MA) and A. K. BEJCZY (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985. Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 2-15 to 2-22. refs

This paper describes recent developments at JPL aimed at enhancing the operator's awareness of the remote task he or she is controlling in space teleoperation. The first development is

related to the use of force-reflecting or bilateral manual control in weightless condition. The second development is related to integrated graphics displays of force and torque information originating from a remote robot hand. The third development is related to a distributed computational system in teleoperation organized in two groups: one integrated with a remote robot arm and hand, and another integrated with the control station. This computational system carries out interactive automation functions. Author

**A86-34971**

#### **EVOLUTIONARY PATHS FOR ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN OPERATOR INTERACTIONS WITH SPACE STATION ROBOTS**

R. A. HAMMOND, D. C. DORROUGH (Boeing Computer Services Co., Bellevue, WA), and D. P. MEYER (Boeing Aerospace Co., Seattle, WA) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985. Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 7-14 to 7-20.

Two paths have been proposed for the evolution of technologies supporting human interfacing with robots aboard the NASA Space Station: (1) the use of teleoperators (so that human operators are in the control loop as the robot operates) followed by the adoption of autonomous robotics, as the technology advances; and (2) the use of fully independent robots from the outset, but using simple task menus until more autonomous robotic technology is developed. Attention is given to the relative merits of each approach in the illustrative case of EVA robots for routine station keeping tasks. The route of essential robot autonomy is concluded to provide the better EVA system. O.C.

**A86-34980**

#### **SPACE STATION HUMAN PRODUCTIVITY STUDY**

W. R. GONZALEZ (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985. Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 9-7 to 9-10.

A study which is to develop design and operation requirements that will maximize the productiveness of crew performance in space is described. The analysis procedures utilized in this study are examined. Space Station designs and operations that could affect crew performance include: interior architecture, crew support, crew activities, and IVA/EVA interface. The development of a data base and management plans for establishing requirements is discussed. I.F.

**A86-35185#**

#### **SPACE STATION DESIGN CRITERIA FOR LONG-TERM HUMAN HABITATION [ENTWURFSKRITERIEN FUER EINE RAUMSTATION IN HINSICHT AUF LANGZEITAUFWENTHALT DES MENSCHEN]**

P. TETZLAFF (ERNO Raumfahrttechnik GmbH, Bremen, West Germany) DGLR, Jahrestagung, Bonn, West Germany, Sept. 30-Oct. 2, 1985. 11 p. In German. refs (DGLR PAPER 85-147)

The design criteria of technologies being developed to sustain human habitation aboard the Space Station for long periods are discussed. Systems aimed at maintaining life functions and to help astronauts cope with weightlessness are emphasized. Particular problem areas in these technologies are mentioned. C.D.

**A86-35426**

#### **AEROSPACE BEHAVIORAL ENGINEERING TECHNOLOGY CONFERENCE, 4TH, LONG BEACH, CA, OCTOBER 14-17, 1985, PROCEEDINGS**

Conference sponsored by SAE, Warrendale, PA, Society of Automotive Engineers, Inc., 1985, 444 p. For individual items see A86-35427 to A86-35458. (SAE P-168)

Papers are presented on assessing human fitness and performance; the use of simulation as a cockpit design tool; the



man-machine interface; the Space Station; and human performance. Consideration is given to advanced transport aircraft technology; operator workload analysis; rotorcraft missions; the pilot in the operational loop; and flight crew training. Topics also discussed include cockpit communications; color displays; commercial air transport and general aviation operations; and space and military operations. I.F.

**A86-35431**

## **COCKPIT AUTOMATION - DESIGN AND IMPLEMENTATION ISSUES**

R. W. MOSS and J. M. REISING (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 41-45. refs (SAE PAPER 851921)

The relationship between pilots and the electronic crew member (EC) is discussed. The use of automation for decision making and its reliability are examined; the roles of the pilot and EC in decision making are studied. The implementation of the EC is described. Three examples of EC/pilot interaction are presented. I.F.

**A86-35432**

## **PILOT VEHICLE INTERFACES WITH SMART AVIONICS SYSTEMS**

L. D. POHLMANN, J. B. SHELNUTT, and J. D. GILMOUR (Boeing Military Airplane Co., Seattle, WA) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 47-53. refs (SAE PAPER 851923)

Design goals for the development of smart pilot vehicle interfaces (PVIs) are examined. The basic characteristics of smart PVIs and the pilot's role in combat aircraft are described. The need for the PVIs to anticipate pilot-system communication requirements, and the pilot/PVIs interaction required for evaluating situations are studied. Methods of presenting and regulating the PVIs information for the pilots are discussed. The ability of the PVIs to discuss abstract ideas such as strategy, risk, and tactics, and the use of direct communication of the pilot's intent to the avionics systems are proposed. I.F.

**A86-35433\*** Boeing Aerospace Co., Seattle, Wash.

## **SPACE STATION CREW INTERFACE SPECIFICATIONS AND STANDARDS**

C. W. GEER, K. H. MILLER (Boeing Aerospace Co., Seattle, WA), and J. L. LEWIS (NASA, Johnson Space Center, Houston, TX) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 57-70. (SAE PAPER 851801)

NASA's Space Station Human Productivity and Man/System Integration Standards programs are described. The data collection methodologies and analyses utilized in the productivity study are examined. The study reveals that attention to habitability is required in order to maximize human productivity for on-orbit operations. The nine program tasks used to develop standards for man/system integration are discussed. I.F.

**A86-35435\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

## **SPACE STATION CREW WORKLOAD - STATION OPERATIONS AND CUSTOMER ACCOMMODATIONS**

G. L. SHINKLE (NASA, Johnson Space Center, Houston, TX) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 75-81. refs (SAE PAPER 851803)

The features of the Space Station which permit crew members to utilize work time for payload operations are discussed. The user orientation, modular design, nonstressful flight regime, in space construction, on board control, automation and robotics, and

maintenance and servicing of the Space Station are examined. The proposed crew size, skills, and functions as station operator and mission specialists are described. Mission objectives and crew functions, which include performing material processing, life science and astronomy experiments, satellite and payload equipment servicing, systems monitoring and control, maintenance and repair, Orbital Maneuvering Vehicle and Mobile Remote Manipulator System operations, on board planning, housekeeping, and health maintenance and recreation, are studied. I.F.

**A86-35440**

## **WORKLOAD ASSESSMENT - PROGRESS DURING THE LAST DECADE**

T. M. MCCLOY and W. L. DERRICK (U.S. Air Force Academy, Colorado Springs, CO) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 125-130. USAF-supported research. refs

(SAE PAPER 851877)

Over the last decade, considerable research has been conducted on the construct of operator workload and its measurement. From this research, both theory and methods have evolved to provide valid assessment of this construct. Two classes of assessment methods, secondary tasks and subjective scales, dominate the literature at this time. This paper traces the development of both methods, ties their use to current theories of human processing resources, and evaluates both with respect to five criteria. Author

**A86-35454\*** Miami Univ., Fla.

## **COCKPIT AUTOMATION - IN NEED OF A PHILOSOPHY**

E. L. WIENER (Miami, University, FL) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 369-375. refs (Contract NCC2-152)

(SAE PAPER 851956)

Concern has been expressed over the rapid development and deployment of automatic devices in transport aircraft, due mainly to the human interface and particularly the role of automation in inducing human error. The paper discusses the need for coherent philosophies of automation, and proposes several approaches: (1) flight management by exception, which states that as long as a crew stays within the bounds of regulations, air traffic control and flight safety, it may fly as it sees fit; (2) exceptions by forecasting, where the use of forecasting models would predict boundary penetration, rather than waiting for it to happen; (3) goal-sharing, where a computer is informed of overall goals, and subsequently has the capability of checking inputs and aircraft position for consistency with the overall goal or intentions; and (4) artificial intelligence and expert systems, where intelligent machines could mimic human reason. K.K.

**A86-35460**

## **CONTROL ERRORS: PSYCHOLOGICAL CAUSES - AN AUTOMATED METHOD OF ANALYSIS [OSHIBKI UPRAVLENIYA: PSIKHOLOGICHESKIE PRICHINY, METOD AVTOMATIZIROVANNOGO ANALIZA]**

M. A. KOTIK and A. M. EMELIANOV Tallinn, Izdatel'stvo Valgus, 1985, 391 p. In Russian. refs

An analysis is made of the psychological causes of human errors occurring in the control of technical and organizations. Various psychological theories explaining the nature of such errors are discussed, as are their relation to the individual qualities of the operator (administrator) and approaches to the analysis and prevention of control errors. A method of automatic error analysis is described whereby a computer is used to identify and eliminate the causes of errors. Practical applications of the method are illustrated by examples. V.L.

A86-36172\* Tufts Univ., Medford, Mass.

**THE EFFECTS OF SYNTACTIC COMPLEXITY ON THE HUMAN-COMPUTER INTERACTION**

R. A. CHECHILE, R. N. FLEISCHMAN, and D. M. SADOSKI (Tufts University, Medford, MA) Human Factors (ISSN 0018-7208), vol. 28, Feb. 1986, p. 11-22. refs  
(Contract NAG3-51)

Three divided-attention experiments were performed to evaluate the effectiveness of a syntactic analysis of the primary task of editing flight route-way-point information. For all editing conditions, a formal syntactic expression was developed for the operator's interaction with the computer. In terms of the syntactic expression, four measures of syntactic were examined. Increased syntactic complexity did increase the time to train operators, but once the operators were trained, syntactic complexity did not influence the divided-attention performance. However, the number of memory retrievals required of the operator significantly accounted for the variation in the accuracy, workload, and task completion time found on the different editing tasks under attention-sharing conditions.

Author

A86-36316

**BIOIMPEDANCE MEASUREMENT WITH RESPECT TO PULSATILE PULMONARY BLOOD FLOW**

T. R. WENG, M. KATAYAMA, E. K. MOTOYAMA, and R. P. HIRSCH (Pittsburgh, University, PA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, May 1986, p. 449-456. Research supported by the Children's Hospital of Pittsburgh and University of Pittsburgh. refs

The feasibility of using impedance plethysmography (IPG) to estimate pulsatile pulmonary distribution in seated objects is evaluated at three lung volumes, RV, FRC and TLC. The upright lung was divided into four equal sampling areas dorsally along the paravertebral space. The Kubicek formula was employed and results indicated a decrease in regional base resistance from the top to 3/4 down the lung and then a leveling off, while there was an increase in regional perfusion from the apex to 3/4 down, and a subsequent decrease. The sum of regional base resistance values was larger than the total sampling field resistance field, a discrepancy explained by the lead field theory. This IPG-determined regional perfusion gradient may represent the pulsatile perfusion gradient, as impedance analyzer outputs are intimately linked to the pulse-synchronous pulsatile nature of pulmonary blood flow. Hence, the advantages of the IPG technique lie in its safety, its noninvasiveness, and its simplicity in assessing regional pulmonary blood flow semiquantitatively in clinical settings or unusual environments.

K.K.

A86-36499

**HYGIENIC ASSESSMENT OF THE ELECTROMAGNETIC RADIATION LEVELS GENERATED BY RADAR INSTALLATIONS [GIGIENICHESKAIA OTSENKA UROVNEI ELEKTROMAGNITNYKH POLEI, SOZDAVAEMYKH RADIOLOKATSIONNYMI STANTSIIAMI]**

V. M. GAVRIUTIN and E. G. ZHILIAEV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Feb. 1986, p. 32-34. In Russian.

A method is described for evaluating the safety of an electromagnetic environment surrounding radar installations. The procedure is based on a plot of radar antenna systems and the residence and work locations on a detailed topographic map and of a relief profile correlated with the same area. The drawing of vertical projection lines between two maps permits the construction of a distribution chart for the electromagnetic radiation, on the basis of which safe locations for human residence and work can be determined.

I.S.

A86-36527

**AN INFORMATIONAL ASSESSMENT OF CHANGES IN THE PHYSIOLOGICAL CHARACTERISTICS OF AN OPERATOR UNDER DIFFERENT WORK REGIMENS [INFORMATSIONNYI PODKHOD K OTSENKE IZMENENII FIZIOLOGICHESKIKH KHA RAKTERISTIK OPERATORA PRI RAZNYKH REZHIMAKH EGO RABOTY]**

IU. P. GORGO (Kievskii Gosudarstvennyi Universitet, Kiev, Ukrainian SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 12, Mar.-Apr. 1986, p. 253-257. In Russian. refs

A PNN-2 psychoanalyzer that issues multicolored signals requiring timed responses was used to assess the subjects' ability to concentrate. At the same time, the subjects' EKG R-R cardiointervals were recorded automatically. The test conditions simulated normal work tempo, work requiring maximal concentration, and the no-work (control) conditions. The time intervals needed to respond to simple stimuli were found to be shorter under conditions of concentrated activity than under conditions of normal work. The lengths of the latent response periods correlated reliably with the extent of organization of the R-R cardiointervals, indicating that this parameter can be used in assessing the ability to concentrate and thus the potential efficiency of an operator under changing work regimens.

I.S.

A86-36536

**METHOD FOR THE QUANTITATIVE DETERMINATION OF THE PARASYMPATHETIC REGULATION OF CARDIAC ACTIVITY IN OPERATORS WORKING IN SEALED CHAMBERS [METOD KOLICHESTVENNOGO OPREDELENIIA PARASIMPATICHESKOI REGULIATSII SERDECHNOI DEIATEL'NOSTI V USLOVIAKH PREBYVANIIA OPERATORA V GERMOOB'EMAKH]**

A. A. ANTONOV and E. B. PETROVA Fiziologiya Cheloveka (ISSN 0131-1646), vol. 12, Mar.-Apr. 1986, p. 340-342. In Russian. refs

A quantitative index measuring the parasympathetic effect on the cardiac activity was defined on the basis of EKG characteristics of cardiac cycles. Experiments were conducted in male subjects performing operational work for 5 hrs in a sealed chamber. The subjects received various doses of Inderal taken orally or a placebo. While in the control subjects (placebo), the parasympathetic index increased 2 to 3 times at the end of the experiment, the subjects receiving 0.16 g of Inderal exhibited 30-fold increases of the index, indicating the high sensitivity of the index to changes in the vagus activity (effected by Inderal). The method can be used to characterize vagotonia.

I.S.

A86-36695

**VISUAL-SEARCH EFFICIENCY [EFFEKTIVNOST' VIZUAL'NOGO POISKA]**

N. P. TRAVNIKOVA Moscow, Izdatel'stvo Mashinostroenie, 1985, 128 p. In Russian. refs

An effort is made to summarize and systematize literature data on visual search (VS). This makes it possible to define the main parameters of VS, to assess their effect on the detection of objects, and to derive analytical relationships for these parameters which would make it possible to predict the detection of various objects. Particular consideration is given to the threshold conditions for the observation of objects with the unaided eye; the characteristics of the VS of extended objects; the search for point sources of light; the estimation of the probability of object detection; and methods for assessing VS efficiency.

B.J.

**A86-36852#****THE USE OF ELLIPSOIDAL SOLIDS TO DISPLAY HUMAN BODY DYNAMIC RESPONSE**

D. H. LAANANEN and D. KALITA (Arizona State University, Tempe) IN: Computers in engineering 1985; Proceedings of the International Computers in Engineering Conference and Exhibition, Boston, MA, August 4-8, 1985. Volume 2. New York, American Society of Mechanical Engineers, 1985, p. 11-17. refs (Contract DOT-FA03-84-P-01649)

An algorithm for displaying the human body modeled as a set of ellipsoids with hidden lines omitted is described. The algorithm is implemented as a post-processor for a dynamic simulation of an aircraft occupant and seat in a crash environment. It includes consideration of complete penetration of one ellipsoid into another and total obscuration of one by another, features which are desirable for display of the abnormal body positions that can result in a vehicle crash. Also, interaction of the ellipsoids with the polygonal representations of the restraint system and seat has been considered. Results are illustrated by examples of output produced for an aircraft crash simulation. Author

**A86-36879#****SIMULATION OF AIRCRAFT SEAT RESPONSE TO A CRASH ENVIRONMENT**

D. H. LAANANEN (Arizona State University, Tempe) IN: Computers in engineering 1985; Proceedings of the International Computers in Engineering Conference and Exhibition, Boston, MA, August 4-8, 1985. Volume 3. New York, American Society of Mechanical Engineers, 1985, p. 241-246. refs (Contract DOT-FA03-84-P-01649)

A three-dimensional mathematical model of an aircraft seat, occupant, and restraint system has been developed for use in analysis of light aircraft crashworthiness. Because of the significant role played by the seat in overall system crashworthiness, a finite element model of the seat structure is included. The seat model can accommodate large displacements, nonlinear material behavior, and local buckling of tubular elements. The occupant model consists of twelve segments whose dimensions and inertial properties have been determined from studies of human body anthropometry and kinematics and from measurements of anthropomorphic test dummies. The seat and occupant models are described, along with the simulation program, and some examples of output data are provided. Author

**A86-36940****THE ROLE OF FLIGHT SIMULATION IN HELICOPTER CREW STATION DESIGN**

J. N. DEMASI and H. P. HARPER (Sikorsky Aircraft, Stratford, CT) IN: Flight simulation/simulators; Proceedings of the Aerospace Technology Conference and Exposition, Long Beach, CA, October 14-17, 1985. Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 1-10. refs (SAE PAPER 851900)

The need for simulation is assessed in the context of changing missions and technology; and the helicopter simulation facilities at the Sikorsky Aircraft Division are described in detail. These facilities include the human factors engineering laboratory, the avionics laboratory, the fixed-base simulator, the motion base simulator, and an in-flight simulator. It has been shown that simulation, an essential part of the crew station design process, can be applied at many levels. Simulator capabilities must cover a broad spectrum of fidelity levels with the capability to tie real hardware with the software simulation. It is concluded that in-flight simulation is necessary to provide realism for critical mission elements and to provide a validation of anchor points. Block diagrams are included. K.K.

**A86-37037\*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**THE HUMAN ROLE IN SPACE: TECHNOLOGY, ECONOMICS AND OPTIMIZATION**

S. B. HALL, ED. (NASA, Marshall Space Flight Center, Huntsville, AL) Park Ridge, NJ, Noyes Publications, 1985, 398 p. No individual items are abstracted in this volume.

Man-machine interactions in space are explored in detail. The role and the degree of direct involvement of humans that will be required in future space missions are investigated. An attempt is made to establish valid criteria for allocating functional activities between humans and machines and to provide insight into the technological requirements, economics, and benefits of the human presence in space. Six basic categories of man-machine interactions are considered: manual, supported, augmented, teleoperated, supervised, and independent. Appendices are included which provide human capability data, project analyses, activity timeline profiles and data sheets for 37 generic activities, support equipment and human capabilities required in these activities, and cumulative costs as a function of activity for seven man-machine modes. C.D.

**A86-37047\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SPACE TELEROBOTICS - A FEW MORE HURDLES**

J. E. PENNINGTON (NASA, Langley Research Center, Hampton, VA) IEEE, International Conference on Robotics and Automation, San Francisco, CA, Apr. 8-10, 1986, Paper. 5 p. refs

In the early 1990's, a telerobotic work system which can be used with the Mobile Remote Manipulator System (MRMS) on the Space Station is to become available. However, a number of difficulties have to be overcome before these plans can be realized. The word 'telerobotics' is used in connection with a system which can function as teleoperator, and which, in addition, has also autonomous functions. Thus, as a robot, the system would automatically perform selected operations using multisensory internal feedback for control. A role for telerobotics is defined, taking into account EVA servicing and repair work, remote satellite refueling, and operations during the Space Station development period. Attention is also given to the definition of a telerobotic system, the definition of the telerobotics technology set, and approaches related to the development of a telerobotic system. G.R.

**N86-25121\*#** Essex Corp., Huntsville, Ala. Space Systems Group.

**THE DESIGN, FABRICATION AND DELIVERY OF A MANIPULATOR FOOT RESTRAINT MOCKUP FOR SPACE TELESCOPE DEVELOPMENT TESTING Final Report**

M. A. HOLLINGSWORTH 11 Apr. 1986 12 p refs

(Contract NAS8-36366)

(NASA-CR-178837; NAS 1.26:178837; H-86-05) Avail: NTIS HC A02/MF A01 CSCL 05H

The Manipulator Foot Restraint (MFR) is a subsystem of the Remote Manipulator System (RMS) which plays a major role in servicing the Hubble Space Telescope (HST) in orbit. Flight drawings were used to construct the MFR to guarantee that the mockup components were functionally equivalent to the flight MFR. Material surface finishes and tolerances that were compatible to the Neutral Buoyancy Simulator (NBS) environment were used. Recommendation for improvements are discussed. B.G.

**N86-25122\*#** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

**PHYSICAL, ANTHROPOMETRICAL, AND BODY COMPOSITION CHARACTERISTICS OF WORKERS AT KENNEDY SPACE CENTER**

M. L. LASLEY Sep. 1985 55 p refs

(Contract NAS10-10285)

(NASA-TM-83102; NAS 1.15:83102) Avail: NTIS HC A04/MF A01 CSCL 05H

At the Kennedy Space Center, workers are often exposed to cardiovascular and muscular stress in job-related activities which

may require a high level of physical fitness in order to safely complete the work task. Similar tasks will be performed at other launch and landing facilities and in space for the Space Station. One such category includes workers who handle toxic propellants and must wear Self-Contained Atmospheric Protective Ensembles (SCAPE) that can weigh 56 lbs. with the air pack. These suits provide a significant physical challenge to many of the workers in terms of carrying this load while moving about and performing work. Furthermore, under some conditions, there is a significant thermal stress. The physical characteristics of these workers are, therefore, of consequence. The purpose of this study was to analyze the anthropometry, body composition, strength, power, endurance, flexibility, aerobic fitness, and blood variables of a representative sample of male KSC SCAPE workers and to compare them with characteristics of other male workers at KSC (total population N=110). Three separate comparisons were made. Author

**N86-25123#** Naval Postgraduate School, Monterey, Calif.  
**MAN-MACHINE SYSTEMS OF THE 1990 DECADE: COGNITIVE FACTORS AND HUMAN INTERFACE ISSUES**  
 P. J. HOFFMAN Aug. 1985 53 p refs  
 (AD-A163865; NPS74-85-002) Avail: NTIS HC A04/MF A01  
 CSCL 05H

This paper presents the primary psychological concepts which are fundamental to the design of man-machine interfaces for intelligent systems of the 1990's. These concepts embrace perception, learning motivation, and cognitive capacities of human operators, in systems which require a high degree of operator-machine interaction. The central role of feedback is emphasized through simple schematic examples, designed to provide an understanding of the reciprocity requirements in man-machine communication. Cognitive theory and recent experimental data form the basis for discussion of visual image storage, short-term memory, long-term memory, transfer rates and buffering of information being processed by the human operator, under control of a central processor with a cycle time of roughly 70 milliseconds. Systems of the 1990 era will provide increased capability for high-speed processing of data and will utilize increasing numbers of decision-aides, spreadsheets and AI tools. Users of these systems will be components of networks, linked via efficient communication systems to other users and other subsystems. These developments will lead to fundamental changes in the work place. GRA

**N86-25124#** Naval Submarine Medical Research Lab., Groton, Conn.  
**THE EFFECT OF COLD TRAINING AND THE WEARING OF GLOVES ON MANUAL PERFORMANCE IN THE COLD: A COMPARISON OF PURE ABILITY AND OPERATIONAL TASKS**  
**Final Report**  
 W. H. ROGERS 14 Nov. 1985 19 p refs  
 (AD-A163893; NSMRL-1067) Avail: NTIS HC A02/MF A01  
 CSCL 06K

Cold-induced manual performance decrements pose a serious problem for military cold weather operations. Experiments were based on the notion that the amount of decrement, and possibly the best means for reducing that decrement, depend on the specific motor abilities required to perform a given task. Experiments have been performed using a battery of pure-ability tasks so that ultimately results could be generalized to any task. The study conducted here had the following goals: (1) to complement the previous studies in terms of the cold temperatures tested, and obtain profiles of performance of decrements and cold-injury dangers across a range of cold temperatures; (2) to assess the wearing of gloves and temperature-specific training as potential methods of reducing or eliminating cold-induced manual performance decrements; and (3) to validate and compare results previously and currently obtained using pure-ability tasks with those obtained using operational tasks. A battery of five pure ability and four operational tasks were administered to six four-man groups of U.S. Marines. Three groups practiced the tasks at room temperature on the first of three training days and at -10 C on

the other two training days, while the other three groups practiced at room temperature on all three days. GRA

**N86-25125#** Naval Submarine Medical Research Lab., Groton, Conn.  
**AN EVALUATION OF COLOR SETS FOR CRT DISPLAYS Interim Report**  
 D. F. NERI, A. R. JACOBSON, and S. M. LURIA 31 Dec. 1985  
 30 p refs  
 (AD-A163894; NSMRL-1068) Avail: NTIS HC A03/MF A01  
 CSCL 06P

Ten subjects performed a color matching task with ten sets of seven colors, adapted from sets recommended in the literature. The color sets covered a wide range in color difference values. Performance with some color sets was significantly better than that with others on a task where color discrimination was important and the colors needed to be discriminated quickly and accurately. Effectiveness of a color set did not depend on the inclusion of any particular colors; rather, the relationships among colors proved to be important. The larger the color difference value between the two most perceptually similar members of a set, the shorter the reaction time and the fewer the errors on the color matching task. Author (GRA)

**N86-25126#** National Inst. for Occupational Safety and Health, Cincinnati, Ohio. Div. of Biomedical and Behavioral Science.  
**COMPENDIUM OF PROTECTIVE EYEWEAR**  
 C. E. MOSS Mar. 1985 87 p refs  
 (PB86-135779) Avail: NTIS HC A05/MF A01 CSCL 06Q

Wearing appropriate eye and face protection devices will prevent or minimize most eye and/or facial injuries. However, at present there is no data source available on commercially available eye and face protectors. To provide characteristics and other product information, this compendium has been developed to list all commercially available eyewear products manufactured in the United States as of July 1, 1984. The protectors listed in this compendium include spectacles, goggles, welding helmets/hand shields, face shields, and filter plates. The information provided will assist the health and safety community in selecting appropriate eye and face protection for the job. GRA

**N86-25993#** School of Aerospace Medicine, Brooks AFB, Tex.  
**A SMALL OXYGEN CONCENTRATOR Final Report, Jun. 1983 - Jul. 1984**  
 C. F. THEIS, K. G. IKELS, and R. G. DORNES Dec. 1985 25 p  
 (AD-A163145; USAFSAM-TR-85-18) Avail: NTIS HC A02/MF A01 CSCL 06K

Onboard oxygen generating systems (OBOGS) require large quantities of air. When toxic contaminants are present, this air volume can become a problem. A small oxygen concentrator (SOC) was developed to operate at 10% the air volume and 4% the molecular sieve weight of the OBOGS. This paper gives detailed instructions on the construction of the SOC. The SOC was tested at inlet pressures of 10, 20, 30, and 40 psig and at product flows of 0.25, 0.50, 1.00, and 1.50 lpm. The SOC beds were packed with 5A or 13X molecular sieve. Additional tests were conducted with the SOC beds at 25 C, 50 C, and 60 C and using 5A molecular sieve. The SOC performance at various inlet pressures and temperatures, as measured by the oxygen concentration in the product gas, demonstrates characteristics similar to the performance of the full-size OBOGS. GRA

## PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

**A86-33668**

**A SEARCH FOR INTERSTELLAR GLYCINE**

I. I. BERULIS, G. WINNEWISER, V. V. KRASNOV (AN SSSR, Fizicheskii Institut, Moscow, USSR), and R. L. SOROCHENKO (Koeln, Universitaet, Cologne, West Germany) (Pis'ma v Astronomicheskii Zhurnal, vol. 11, Aug. 1985, p. 599-604) Soviet Astronomy Letters (ISSN 0360-0327), vol. 11, July-Aug. 1985, p. 251-253. Translation. refs

A search for three 8-mm line microwave lines of glycine conformer II toward Sgr B2, W51, and Ori A was conducted with the RT-22 telescope of the Pushchino Radio Astronomy Station during 1982-1983. The search placed respective upper limits of  $(4, 6, 2) \times 10$  to the 13th/sq cm on the column density. B.J.

**A86-34489**

**SIMULATION OF THERMAL POLYCONDENSATION PROCESSES OF AMINO ACIDS DURING THE MIGRATION OF THEIR AQUEOUS SOLUTIONS IN THE EARTH'S LITHOSPHERE [MODELIROVANIE PROTSESSOV TERMICHESKOI POLIKONDENSATSII AMINOKISLOT PRI MIGRATSII IKH VODNYKH RASTVOROV V LITOSFERE ZEMLI]**

G. A. LAVRENT'EV, T. F. STRIGUNKOVA, I. A. EGOROV, L. IU. RAKITIN, and L. A. PISKUNOVA (AN SSSR, Institut Biokhimii, Moscow, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 287, no. 2, 1986, p. 455-459. In Russian. refs

The possibility of abiogenic peptide synthesis in the earth's lithosphere was investigated under conditions simulating the geological environment in the lithosphere. A continuous flow of amino acid solutions (containing glycine, alanine, valine, leucine, isoleucine, phenylalanine, lysine, arginine, aspartic acid, and glutamic acid) was passed under pressure through a heated reactor filled with layers of crushed kaolinite. At conditions of 200 C and 20 atm nitrogen, significant amounts of peptides (of 700 and higher molecular weight) are synthesized. Compared with the starting solution, the peptides are considerably enriched in lysine. Moreover, the products contain measurable amounts of serine, absent from the starting solution. A possibility is suggested that life might have originated in the lithosphere, before it appeared on the earth surface. I.S.

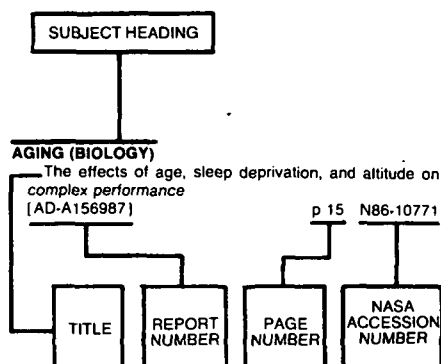
**A86-36766**

**COSMOLOGICAL AND ANTHROPIC PRINCIPLES, COSMIC AND PLANETARY EVENTS, AND THE EXISTENCE OF LIFE IN THE UNIVERSE**

M. SUBOTOWICZ (Lublin, Uniwersytet, Poland) Postepy Astronautyki (ISSN 0373-5982), vol. 18, no. 3-4, 1985, p. 113-131. refs

A discussion is presented which assesses the consequences for CETI and SETI research of the probabilities for the existence of extraterrestrial intelligent life implicit in the 'anthropic principle' (AP). AP, while essentially independent of the existing body of physical theory, is strongly supportive of the universality of intelligent life. Attention is also given to other threats, primarily of a physical or practical character, to the conduct of SETI efforts or the accomplishment of CETI; these encompass termination of SETI funding in virtue of public and government indifference, the jamming of CETI reception by increasingly powerful anthropogenic transmissions in orbital space, and the nonsynchronicity of high civilizations capable of SETI/CETI efforts from proximate planetary systems. O.C.

## Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

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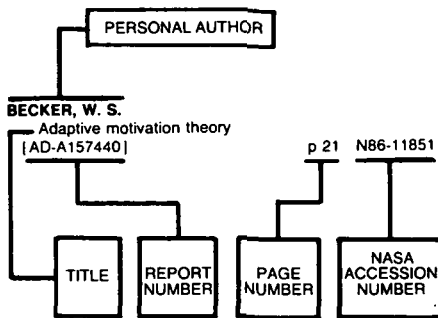
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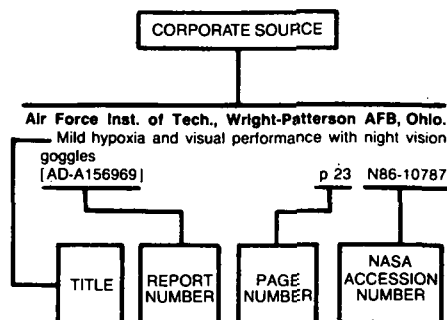
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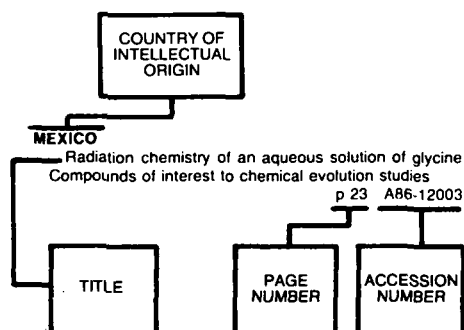
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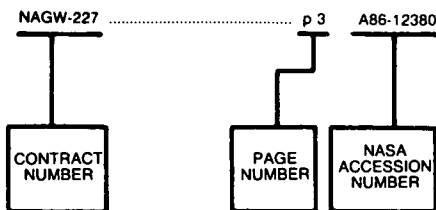
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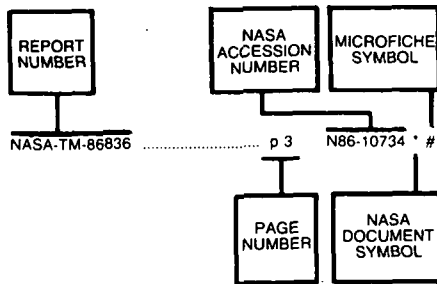
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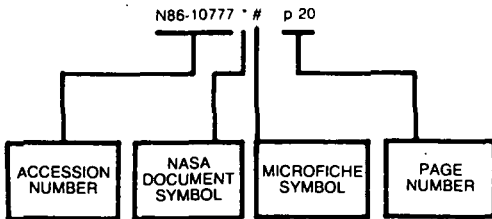
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(808) 948-8230

## **IDAHO**

### **UNIV. OF IDAHO LIBRARY**

Documents Section  
Moscow, ID 83843  
(208) 885-6344

## **ILLINOIS**

### **ILLINOIS STATE LIBRARY**

Information Services Branch  
Centennial Building  
Springfield, IL 62706  
(217) 782-5185

## **INDIANA**

### **INDIANA STATE LIBRARY**

Serials Documents Section  
140 North Senate Avenue  
Indianapolis, IN 46204  
(317) 232-3686

## **IOWA**

### **UNIV. OF IOWA LIBRARIES**

Govt. Documents Department  
Iowa City, IA 52242  
(319) 353-3318

## **KANSAS**

### **UNIVERSITY OF KANSAS**

Doc. Collect—Spencer Lib.  
Lawrence, KS 66045  
(913) 864-4662

## **KENTUCKY**

### **UNIV. OF KENTUCKY LIBRARIES**

Govt. Pub. Department  
Lexington, KY 40506  
(606) 257-3139

## **LOUISIANA**

### **LOUISIANA STATE UNIVERSITY**

Middleton Library  
Govt. Docs. Dept.  
Baton Rouge, LA 70803  
(504) 388-2570

### **LOUISIANA TECHNICAL UNIV. LIBRARY**

Documents Department  
Ruston, LA 71272  
(318) 257-4962

## **MAINE**

### **UNIVERSITY OF MAINE**

Raymond H. Fogler Library  
Tri-State Regional Documents  
Depository  
Orono, ME 04469  
(207) 581-1680

## **MARYLAND**

### **UNIVERSITY OF MARYLAND**

McKeldin Lib.—Doc. Div.  
College Park, MD 20742  
(301) 454-3034

## **MASSACHUSETTS**

### **BOSTON PUBLIC LIBRARY**

Government Docs. Dept.  
Boston, MA 02117  
(617) 536-5400 ext. 226

## **MICHIGAN**

### **DETROIT PUBLIC LIBRARY**

Sociology Department  
5201 Woodward Avenue  
Detroit, MI 48202  
(313) 833-1409

### **MICHIGAN STATE LIBRARY**

P.O. Box 30007  
Lansing, MI 48909  
(517) 373-0640

## **MINNESOTA**

### **UNIVERSITY OF MINNESOTA**

Government Pubs. Division  
409 Wilson Library  
309 19th Avenue South  
Minneapolis, MN 55455  
(612) 373-7813

## **MISSISSIPPI**

### **UNIV. OF MISSISSIPPI LIB.**

Documents Department  
University, MS 38677  
(601) 232-5857

## **MONTANA**

### **UNIV. OF MONTANA**

Mansfield Library  
Documents Division  
Missoula, MT 59812  
(406) 243-6700

## **NEBRASKA**

### **NEBRASKA LIBRARY COMM.**

Federal Documents  
1420 P Street  
Lincoln, NE 68508  
(402) 471-2045  
In cooperation with University of  
Nebraska-Lincoln

## **NEVADA**

### **UNIVERSITY OF NEVADA LIB.**

Govt. Pub. Department  
Reno, NV 89557  
(702) 784-6579

## **NEW JERSEY**

### **NEWARK PUBLIC LIBRARY**

5 Washington Street  
Newark, NJ 07101  
(201) 733-7812

## **NEW MEXICO**

### **UNIVERSITY OF NEW MEXICO**

Zimmerman Library  
Government Pub. Dept.  
Albuquerque, NM 87131  
(505) 277-5441

### **NEW MEXICO STATE LIBRARY**

Reference Department  
325 Don Gaspar Avenue  
Santa Fe, NM 87501  
(505) 827-2033, ext. 22

## **NEW YORK**

### **NEW YORK STATE LIBRARY**

Empire State Plaza  
Albany, NY 12230  
(518) 474-5563

## **NORTH CAROLINA**

### **UNIVERSITY OF NORTH CAROLINA**

#### **AT CHAPEL HILL**

Wilson Library  
BA/SS Documents Division  
Chapel Hill, NC 27515  
(919) 962-1321

## **NORTH DAKOTA**

### **UNIVERSITY OF NORTH DAKOTA**

Chester Fritz Library  
Documents Department  
Grand Forks, ND 58202  
(701) 777-2617, ext. 27  
(In cooperation with North  
Dakota State Univ. Library)

## **OHIO**

### **STATE LIBRARY OF OHIO**

Documents Department  
65 South Front Street  
Columbus, OH 43215  
(614) 462-7051

## **OKLAHOMA**

### **OKLAHOMA DEPT. OF LIB.**

Government Documents  
200 NE 18th Street  
Oklahoma City, OK 73105  
(405) 521-2502

### **OKLAHOMA STATE UNIV. LIB.**

Documents Department  
Stillwater, OK 74078  
(405) 624-6546

## **OREGON**

### **PORTLAND STATE UNIV. LIB.**

Documents Department  
P.O. Box 1151  
Portland, OR 97207  
(503) 229-3673

## **PENNSYLVANIA**

### **STATE LIBRARY OF PENN.**

Government Pub. Section  
P.O. Box 1601  
Harrisburg, PA 17105  
(717) 787-3752

## **TEXAS**

### **TEXAS STATE LIBRARY**

Public Services Department  
P.O. Box 12927—Cap. Sta.  
Austin, TX 78753  
(512) 471-2996

### **TEXAS TECH UNIV. LIBRARY**

Govt. Documents Department  
Lubbock, TX 79409  
(806) 742-2268

## **UTAH**

### **UTAH STATE UNIVERSITY**

Merrill Library, U.M.C. 30  
Logan, UT 84322  
(801) 750-2682

## **VIRGINIA**

### **UNIVERSITY OF VIRGINIA**

Alderman Lib.—Public Doc.  
Charlottesville, VA 22901  
(804) 924-3133

## **WASHINGTON**

### **WASHINGTON STATE LIBRARY**

Documents Section  
Olympia, WA 98504  
(206) 753-4027

## **WEST VIRGINIA**

### **WEST VIRGINIA UNIV. LIB.**

Documents Department  
Morgantown, WV 26506  
(304) 293-3640

## **WISCONSIN**

### **MILWAUKEE PUBLIC LIBRARY**

814 West Wisconsin Avenue  
Milwaukee, WI 53233  
(414) 278-3000

### **ST. HIST LIB. OF WISCONSIN**

Government Pub. Section  
816 State Street  
Madison, WI 53706  
(608) 262-4347

## **WYOMING**

### **WYOMING STATE LIBRARY**

Supreme Ct. & Library Bld.  
Cheyenne, WY 82002  
(307) 777-6344

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